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UNITED STATES ARMY AVIATION DIGEST

UNITED STATES ARMY AVIATION DIGEST

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Cover: The ROAD division enables commanders to conduct highly mobile offensive operations featuring rapid movement, wide dispersal, deep penetration, exploitation of opportunities, and pursuit.

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

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To be distributed in accordance with requirements stated in DA Form 12.

LETTERS

Sir:

I have just finished reading, with dismay, "Aerial Delivery of a Fire Bomb" in the March issue of the DIGEST. Surely the author can't be serious about delivering napalm with an OH-13. To be sure, his ingenuity, initiative and imagination are commendable. No one questions the desirability of responsive, timely, accurate delivery of napalm, but not with an OH-13. Perhaps this makes an impressive demonstration at Fort Bragg, but I can assure you, from experience, that flying at 200 feet and at 70 knots over a known enemy strong point, against even poorly trained and haphazardly armed insurgents, would result in a far more dramatic conclusion to the demonstration.

I agree, as do all of the aviators in Vietnam, that we must accept losses and that we may be required to "make do" with antiquated or obsolescent equipment, but this is no reason to select the slowest and obviously least suitable aircraft in the inventory. To do so borders on the suicidal. Aggressiveness is a most desirable trait, provided it is tempered with an acute appraisal of what's possible and what's not possible.

From a constructive standpoint, the problem of timely responsive delivery still exists. It is my opinion that consideration should be given to testing the Mohawk as a suitable delivery vehicle.

BERTRAM G. LEACH
Capt, TC
93d Trans Co (Lt Hel)
APO 96, San Francisco, Calif.

Sir:

The article "Rescue Operation in Iran," in the March '63 issue, clearly points out the fact that "the left hand (in Army Aviation) often doesn't know what the right hand is doing."

This is not intended to belittle the initiative and hard work of the aviation personnel mentioned in the article, but to bring to the attention of those concerned and interested the following facts.

UH-1A helicopters in Alaska have been using fiberglas skis for snow landings since the summer of 1961. These skis (see inclosed photo) were purchased by USARAL from a local manufacturer and were tested and approved within this command. UH-1s with these skis have flown during two Arctic winter maneuvers and operated successfully on snow covered fields from sea level up to 8,000+ feet—including numerous operations on and off glaciers.

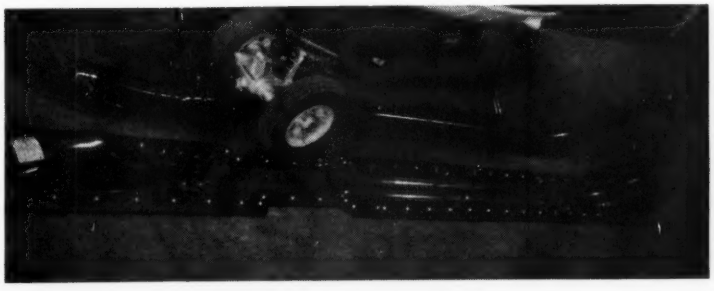
The fiberglas skis remain on the aircraft for year around operations in this theater. In addition to the skis' usefulness for snow operations, they have proven to be highly advantageous in summer missions on muskeg, swamp and tundra. Here they provide additional flotation capability. Their value is further enhanced by the fact that they prevent undue wear and tear on the bottom of the metal skid.

Damage to the ski is easily repairable by any third echelon shop with a fiberglas repair capability. The presence of a narrow steel strip on the underside of each ski minimizes wear on the fiberglas. These strips also help to keep the aircraft from "fish-tailing" when started on a smooth icy surface.

Characteristics of the ski include:
Width—12 inches
Length—12 feet
Thickness—⅜ inch
Weight—45 pounds (per ski, including the hardware) or a total of 90 lbs versus an approximate 150 lbs per set of "wooden planks" as mentioned in your article.

Perhaps "Robbing Peter to pay Paul" isn't really such a bad idea when it comes to the exchange of useful information in Army Aviation!

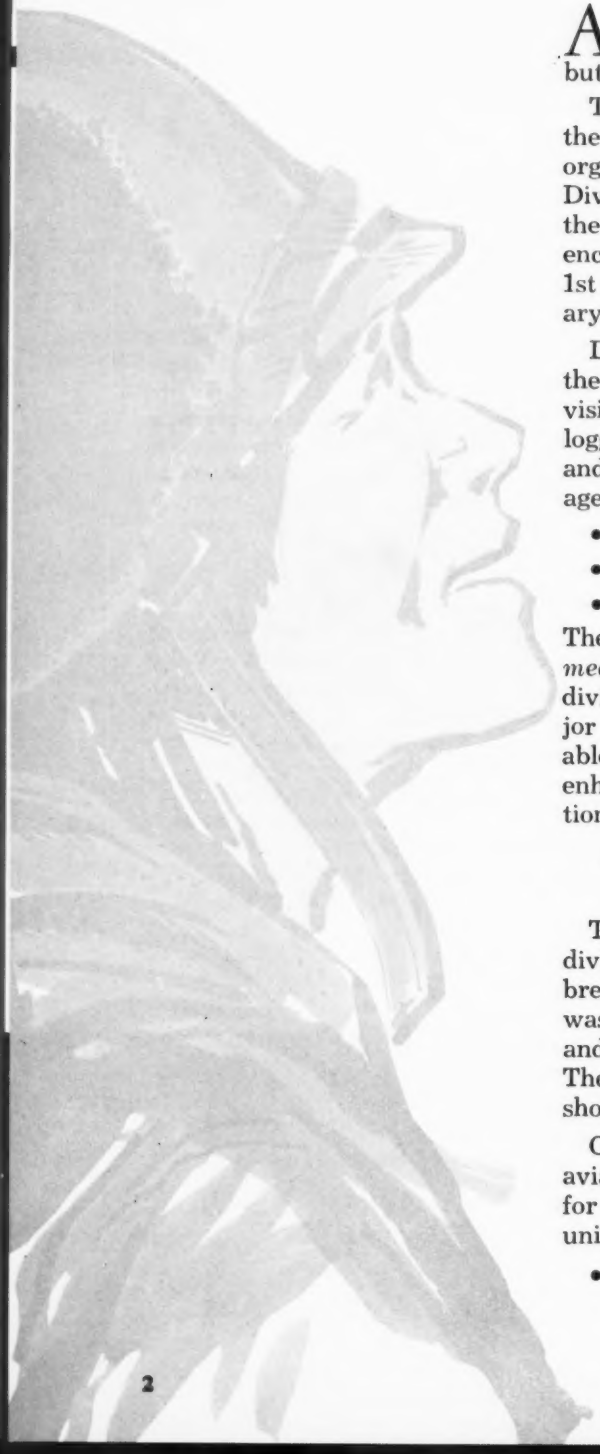
M. M. JESSUP
and
B. W. MERRILL
Capts, TC
80th Trans Co. (LH)



The most significant features of ROAD aviation are: more responsive aircraft for command and control, a major increase in tactical airmobility for troops and supplies, the addition of an air cavalry troop, equipped with armed helicopters, and a broader scope and increased effectiveness of battlefield surveillance.—Maj Gen Ralph E. Haines, Jr., CG 1st Armored Division.

A Year on the ROAD

Lieutenant Colonel John C. Hughes



A YEAR on the road is bound to make a traveler weary, but also much wiser.

This certainly holds true for the Army's first ROAD (Reorganization Objectives, Army Divisions) aviation battalion—the 501st which came into existence with the reactivation of the 1st Armored Division in February 1962 at Fort Hood, Texas.

During their first year with the Army's original ROAD division, 1st Armored aviators logged some 16,000 flight hours and developed dynamic new usage of three decisive "tools":

- aerial surveillance,
- air cavalry reconnaissance,
- airmobility.

These tools are under the *immediate* control of the ROAD division commander and his major subordinates. By being available *when* needed, they greatly enhance the combat and operational potential of the division.

ORGANIZATION AND TRAINING

The only change in the ROAD division's 103 TOE aircraft breakdown during the first year was the deletion of two LOHs and the addition of two U-6s. The distribution of aircraft is shown in figures 1 and 2.

Over 700 men and officers in aviation MOSs provide the skills for the division's nine aviation units:

- 2 line companies in the aviation battalion,
- 1 headquarters company in the aviation battalion,
- 3 platoons, 1 in each of the brigades,
- an artillery aviation section in division artillery,
- the air cavalry troop in the recon squadron,
- 1 aircraft maintenance company in the maintenance battalion.

The original cadre of these aviation units came from the old 501st Aviation Company, which was understrength in personnel and equipment. Consequently, a tremendous influx of aviation personnel occurred early in 1962 to meet TOE requirements.

To facilitate reception, billeting, and training, all aviation units were initially set up in one area, providing centralized control over the assignment of arriving personnel.

When aviators report to a command only one assumption can be safely made—that they can fly. In the 1st Armored, incoming aviators were screened and placed into various categories. Then the difficult task of matching man to machine and machine to unit was made without depriving units of experience needed to meet mission requirements.

Transition courses were estab-

Col Hughes is commander of the 501st Aviation Battalion, Fort Hood, Texas, the first ROAD aviation battalion.

lished to qualify incoming aviators in appropriate aircraft. This took up a great deal of time. For example, over 600 hours of aviator transition time was used in the UH-1 course before support could be rendered the division. It was also necessary to send newly rated aviators on ferry missions so they could accumulate the 250 hours needed for passenger carrying qualification.

Initially, aviators considerably outnumbered flyable aircraft. The division took advantage of this situation by sending selected "fixed-wing-only" pilots to rotary wing school and OV-1 qualification courses.

The influx of aviators hit the division in the last half of the fiscal year when it was necessary to meet annual minimums, administer the annual written examination, and renew instrument tickets. The availability of only two fixed wing aircraft (U-6s) made it necessary for the division to resort to AR 95-63 and allow aviators to maintain instrument tickets only in cases where it was a requirement.

To prepare for the annual writ, a training program, including all of the division's aviators, was designed to cover mandatory Army area subjects. The program embraced some 75 hours of classroom instruction and was offered twice weekly so all Category I, II, and III officers could perform their primary duties and still receive mandatory training.

Incoming CH-21 qualified warrant officers were assigned to the airmobile company and air cavalry troop. Here again pilot transition was required and training was emphasized. Aviators, especially in the air cavalry troop, must receive specialized training in nap-of-the-earth flying, low-level navigation, gunnery, and helicopter armament.

The problem of aviator assignments was satisfactorily resolved without depriving units of needed experience, but it did require judicious and careful planning to keep officer transfers within the command to a minimum. The S1 and S3 functions overlap in this area and *the importance of careful planning cannot be overemphasized.*

The training requirement for enlisted men is an entirely differ-

Figure 1

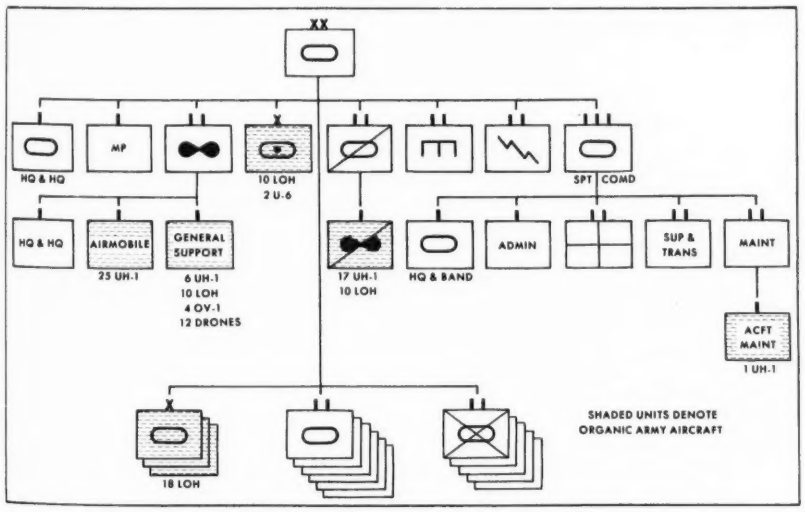
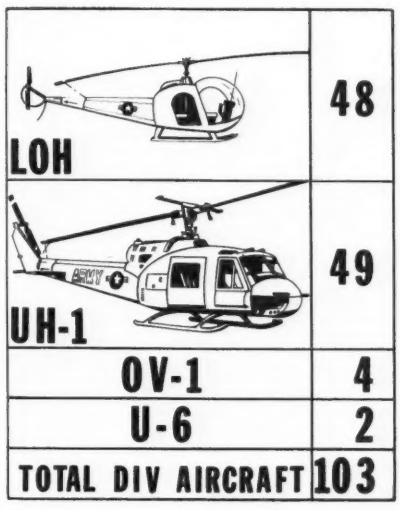


Figure 2



ent story. As in any specialist battalion, the skill level of required personnel varies greatly and covers the wide spectrum of specialties which are not easily mastered in OJT (see fig. 3).

Incoming enlisted personnel were evaluated in their particular MOSs to determine their potential, aptitude, and skill level. This job was monitored by the S1 and S3, but implemented by each unit training and maintenance officer. An excess of fixed wing mechanics and a serious shortage of helicopter mechanics were quickly discovered. Also, a helicopter crewchief shortage was compounded when UH-19 and CH-34 helicopters were received. MOS 675.30 crewchiefs were needed for these aircraft but were not authorized in the division.

The excess fixed wing mechanics were screened and the best qualified sent to Mohawk school. The remainder were given cross training for a 3-week period. Mechanics showing the most aptitude in the cross-training period were sent to helicopter school, and some of those remained for further training as UH-1 mechanics. They were lost to the division for 10-20 weeks, but returned just in time to apply their skills in division exercises.

Despite numerous problems which demanded solutions, the division met its training and mission requirements. At one point spirits were bolstered by the heartening news that 100 critical MOS trained personnel were earmarked for the 1st Armored. They arrived in March, but were not quite what was expected. Fresh out of 8 weeks of basic training, they had been given directed MOSs. This only aggravated the situation.

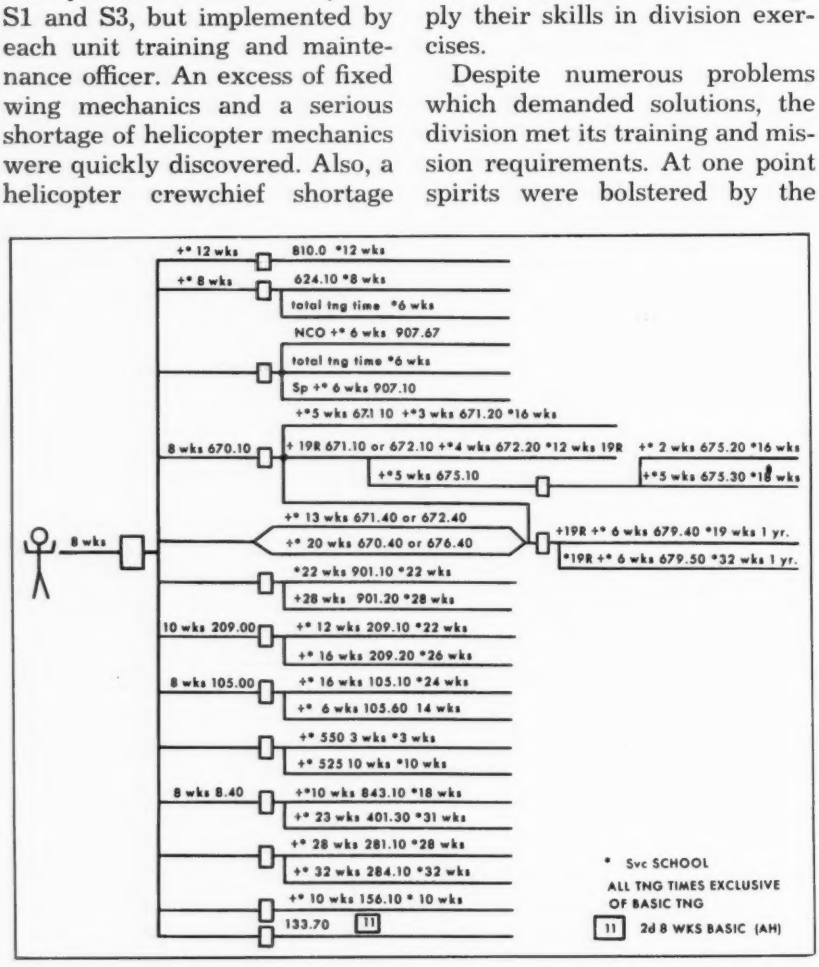


Figure 3, Aviation Battalion Spectrum. Chart shows the many specialties required of enlisted personnel. School training requires several weeks.

The basic trainees were formed into a special company and relieved of all fatigue details. A battalion committee was established and over a 3-week period conducted courses covering all of the basic mandatory training subjects required by CONARC and Fourth Army. Upon completion of this compressed training the new arrivals were farmed out to an appropriate staff section, company, or platoon to receive OJT in their particular MOS fields. As these OJT personnel became proficient in their jobs they were sent to a service school to receive important technical and theoretical background training. Only then did they become really productive.

During the first year on the ROAD, the division sent 51 enlisted men to the 670.0 Aircraft Maintenance Course (Entry); 55 to the 675.1 Single Rotor Observation Helicopter Maintenance Course; and 15 to the 675.2 Single Rotor Turbine Utility Helicopter Maintenance Course. On-post courses were used to the maximum to ease the training load for small groups, such as petroleum handlers, firefighters, and projectionists.

AIRCRAFT PROCUREMENT

Since the 1st Armored was forming the first ROAD division, it enjoyed a relatively high priority on equipment. Fourth Army, and for that matter the entire CONUS east of the Rockies, was searched, and from every nook and cranny aircraft began filtering toward the division. In February 1962, the aircraft inventory was two Beavers, six Chickasaws, seven Sioux, and six Bird Dogs. By 1 July the battalion had received 27 aircraft and the division 42. In December the battalion hit its

peak with 38, while the division had 92, with attachments.

Aircraft pickup was routine with one exception. It seems that receiving an unexpected windfall of 19 UH-1s from the Bell plant should have been "no sweat." But the division had only three aviators qualified in the Iroquois and none of these were current.

After several hurried phone calls, a few TWX messages, and the horrible thought that the aircraft might be diverted to another unit, TMC waived the currency requirement for the first 10 helicopters. With that concession aircraft pickup went smoothly, and the transition program was stepped up with assistance from Fourth Army.

After three months on the ROAD, the various aviation elements were formed into separate aviation units; their aircraft followed them in 30 days. Normal aviation support for command and liaison was performed for the 1st and 2d Armored Divisions, and those necessary VIP flights. In April the division's aviation elements and, in particular, the airmobile company began supporting CONUS. Because of these missions, the airmobile company was unable to train as a unit for any lengthy period (see fig. 4). A similar situation existed in the drone section of the Aviation Battalion General Support Company.

AVIATION BATTALION
FLYING TIME
3 Feb 62—31 Dec 62

Transition Training		1525
STRAC Ferry Time		880
Operational Flights—Ft Hood		4877
Flight Missions other than Ft Hood		1175
	Total	8457

Figure 4

STRAC MOBILITY

After division exercises in August and September, emphasis was placed on the large scale CORE SHIELD maneuver. This was replaced by the modest, brigade sized, THREE PAIRS. The latter was interrupted by the STRAC mobility exercise which took the 1st Armored Division to Fort Stewart, Ga., and other areas in the Southeast.

With its efforts in maintenance directed toward THREE PAIRS, the division was caught by the mobility exercise with a considerable number of aircraft approaching periodic inspections.

Drastic steps were taken to get the aircraft in shape for ferry flights to Fort Stewart. A compromise of 200 hours on each aircraft was accepted for component change items such as generators, gear boxes, and the like. This task was assumed by the supporting Transportation Aircraft Service Division (TASD). With its more experienced personnel, TASD accepted all aircraft and had them ready to meet the deadline. This freed the aviation elements for preparation of their ground vehicles and personal equipment.

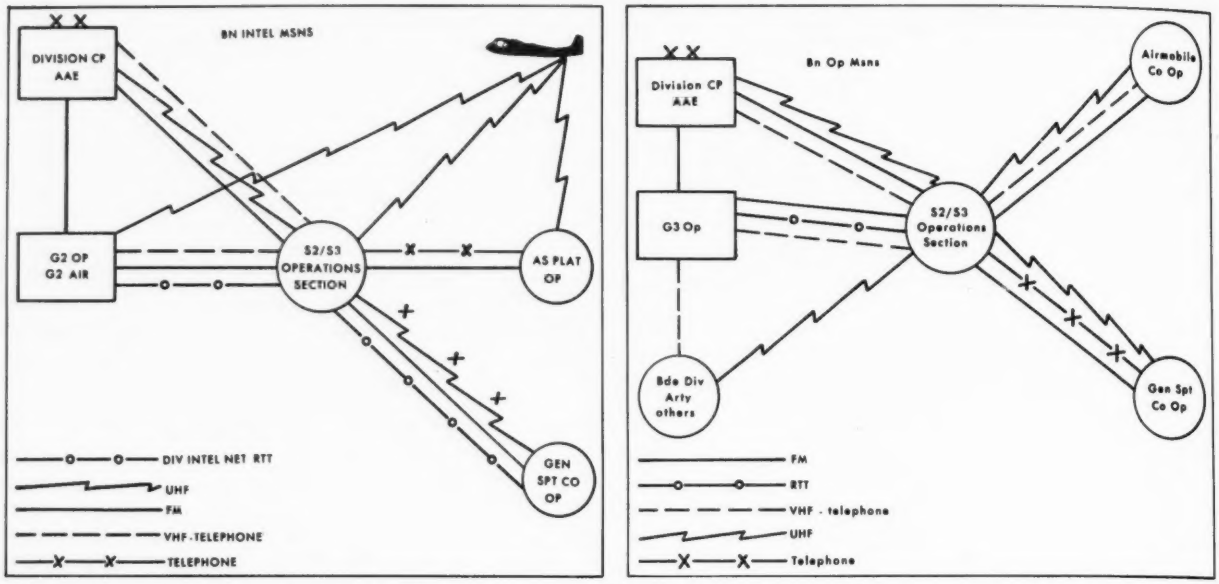
An aviation task force was organized containing aircraft for artillery observation, platoon-sized airmobile operations, command and liaison, an airmobile command post, and an air cavalry troop. Aviators were assigned to the task force on the basis of experience and aircraft qualification. Aircraft resources within the division were expanded to 90 percent of TOE and it became necessary to request a minimum of 15 aviators from Fourth Army.

Routes to Fort Stewart, refueling stops, medical evacuation, overnight quarters, and availability of maintenance support en route were just a few of the planning considerations of the division aviation officer, his assistant, the battalion executive officer, the S3 and the S1. These five officers represent the minimum number required to plan a movement of all division aircraft and are a necessary augmentation to the G2/G3 plans section. Planning was hampered to some extent by high security classification; consequently, dissemination of vital flight information to the individual aviator had to be withheld. As it turned out, this saved the S2 a lot of debriefing sessions.

No consideration was given to any mode of movement for aircraft other than ferry flight. Aircraft accident prevention teams were spaced throughout the various flights. Multiple routes were selected to preclude long refueling stops and overtaxing RON billet facilities. The third echelon maintenance capability was transported by train, along with other elements of the aviation battalion.

Individual and unit training was emphasized at Fort Stewart, and a considerable amount of time was spent on helicopter armament, maintenance (aircraft and vehicular), first aid, survival training, arms qualification, and chemical training.

This mobility exercise placed a real demand on the 1st Armored Division's aviation units.



Figures 5 and 6 show communications systems used with battalion intelligence missions and battalion operations missions.

But it also gave Army Aviation a chance to prove that it can "cut the mustard" under pressure in a ROAD division.

INTELLIGENCE

The aviation battalion S2 has one of the most challenging assignments in the division. By supervising the division's principal intelligence gathering agency, he is, in effect, an extension of the G2. The S2's choice of proper vehicles to accomplish a given intelligence mission ranges from drones to Mohawks to helicopters. He habitually must seek ways to shorten the intelligence chain and to give the commander valid and accurate reports on enemy locations. His success depends upon his initiative and imagination. The average time for a photo mission from time of receipt to a developed print in the hands of the G2 has been 1 hour and 45 minutes.

The establishment of a division FM intelligence net has materially assisted our intelligence effort, since it allows in-flight spot reports to be received instantaneously by all major commands and the G2. These reports are verified by spot photography and photo interpreter flash reports.

Operational missions are given directly to the battalion S3 or forwarded through the Army Aviation element. Any brigade aviation officer may enter the battalion FM or VHF command net at will and request assistance. If he is planning an airlift, a liaison officer (LO) is dispatched to assist him and the brigade commander in this planning. The LO returns to brief the battalion commander and S3, who in turn notifies the assistant division aviation officer in the Division Tactical Operations Center. This system has proved most satisfactory and responsive.

LOGISTICS

A unique feature about the ROAD division is the functionalization of supply and maintenance. All repair of equipment and repair parts supply (except for medical items) are consolidated in the supply and transportation battalion. The activities of these two battalions, along with those of the medical battalion are coordinated by the division Administrative Support Operations Center (ADSOC), the logistical control agency of the division support command. The support command has responsibility for all logistical support within the division. This has taken the implementing and operating functions from the G4 and left him in his primary role of staff planner.

POL

Shortly after its activation, the battalion's aircraft inventory included five types. This represented the total division inventory, since other aviation units had not yet been officially formed from the nucleus being trained in the aviation battalion. Three grades of fuel were required for these five types of aircraft. The receipt of the first Mohawk added JP-4. The division then had less than half of its TOE gas tankers, and a total of four were available for aviation fuels. Fortunately the 1st Armored was never called upon to operate with this POL nightmare under field conditions. The de-

Continued on page 41

Oxygen

OXYGEN, the stuff which allows us to "loose the surly bonds of earth," is a boon to the high-flying pilot and crew. It can also be an insidious HAZARD.

Without proper care and handling, oxygen systems installed for safety can bite back with sudden viciousness.

Recently two mechanics were injured by an explosion which occurred during the recharging of a small portable oxygen cylinder.

When the gauge indicated "Full," one of the mechanics closed the valve on the control panel and began to disconnect the charging line at the cylinder. There was a flash, followed by an explosion. The clothes of one of the men were set on fire, and the other mechanic was also injured.

Investigation revealed that the operation was carried out slowly. The ON/OFF valves were correctly closed, but pressure in the charging lines was not reduced to zero before the cylinder was disconnected.

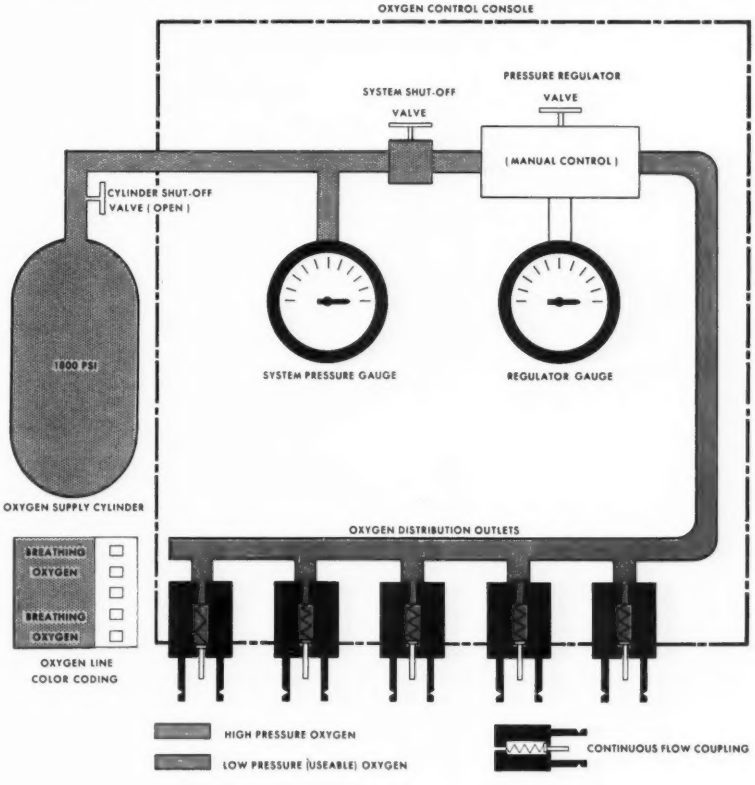
There is one inviolate rule: OXYGEN SHOULD BE HANDLED ONLY BY QUALIFIED PERSONNEL. And even these need to train, retrain, and constantly remind themselves of the safety precautions to be observed.

These simple safety precautions are violated again and again:

Keep all power from electrical or electronic equipment when the ogygen system is open or leaking. When filling oxygen cylinders or working on oxygen lines (color coded green), make sure the aircraft is electrostatically grounded and that the cylinder is grounded to the aircraft.

Pure oxygen will support combustion in oils or petroleum base lubricants. Keep systems clinically clean of oil, grease, dirt, and dust. Install dust caps, plugs, and covers on equipment when not using it. Oil in the wrong place can cause an explosion. Dirt and dust can, too; or they can plug the system.

Recently, a civil aircraft captain lit a cigarette while wearing an oxygen mask around his neck. The oxygen system was not being used. Shortly thereafter, the mask burst into flames, burning the pilot's neck and two fingers as he pulled the mask off. The flight engineer snuffed out the flames. An analysis of the incident indicated that when checking the oxygen equipment before departure, the



captain probably did not completely turn off the emergency valve. The presence of an excessive amount of oxygen together with an accumulation of facial oils on the mask caused the fire when the cigarette was lit.

Similar incidents have occurred when pure oxygen has contacted such apparently harmless things as lip salves or lubricants.

Masks should be periodically washed with soap and water. Tools used by oxygen handlers must be degreased. Clothes worn during system maintenance and recharging should be absolutely free of grease and oils.

Handle cylinders and valves carefully—a broken valve can become a rocket. Open and close valves slowly, by hand only. If the valve cannot be closed by hand, return the cylinder for repair or replacement. Be sure the cylinder is firmly supported before you open or close a valve.

Safety regulations during servicing of the oxygen system should be as rigid as those applied to refueling aircraft. Fire extinguishers should be at hand; smoking or open flames should be prohibited within 50 feet of the aircraft.

Maintenance personnel accustomed to the high pressure (1800 psi) oxygen systems on OV-1, U-8, U-9 and CV-2 aircraft should be especially cautious when recharging unfamiliar transient aircraft.

Aircraft have been destroyed by having high pressure oxygen put into low pressure (50-90 or 400 psi) systems. Never fill a low pressure system without using a pressure limiting regulator.

Properly handled and maintained, oxygen systems and recharging equipment are trouble-free and dependable.

A functioning oxygen system stands between the pilot and hypoxia. It is common sense life insurance to treat it with respect.

The Digest Comes To You Directly From The Printer

From the number of letters received by the DIGEST, it is evident that some units are not getting "the word" about the pinpoint distribution system outlined in Section III, Chapter 3, AR 310-1, dated 20 March 1962.

Starting with the July issue the DIGEST will be mailed directly to units from the printer. The magazine will *no longer* be sent to local AG publications officers for further distribution to units. Some publications stockrooms are still consolidating all requests from units in their distribution system. This is not correct.

Following guidelines in DA Circular 310-57, individual units submit their requests directly to CO, AG Publications Center, 2800 Eastern Blvd., Baltimore, Md., and they will receive the DIGEST directly from the printer (not through a publications stockroom).

How do you know if your unit will get the magazine regularly and without interruption? *Every unit* that wants to get the magazine or has been getting it must submit a request for initial distribution or for continued distribution. The form for all to use is DA Form 12-4.

If you have any doubts, check the AR and DA circular cited above and the back page of the May DIGEST.

Once your unit has submitted a request for the DIGEST to the AG Publications Center in Baltimore, it will be given an *account number*. Any time you wish to change the number of copies your unit receives, use DA Form 12-4 and refer to the account number assigned your unit.

This new pinpoint distribution system is another improvement the Army is using to help everyone get pertinent valuable information on Army Aviation with a minimum of delay.

Check AR 310-1, DA Circular 310-57, DA Form 12-4, the address of Publications Center, Baltimore, Md., and GOOD LUCK!

Certain Cardinal Rules for

Safe Air Operations

Lieutenant Colonel Michael F. Hochella

RULES ARE BASIC to every operation—whether it be a game such as football, an acrobatic stunt, or the serious business of flying. Some rules are set forth in official regulations, as the NCAA rule book or ARs; others, sometimes just as important, are unwritten rules accepted by the individuals involved. These are my seven cardinal rules for safe air operation.

Rule No. I. RESPECT AIRCRAFT DISCREPANCIES

Anyone who flys knows that there are red lines everywhere you look in an aircraft. The most important are those showing operating limits on the instrument panel. Heed them well! A pilot who allows rotor rpm to exceed the rpm limits in autorotation should *not* be, as it were, cussed and discussed, PROVIDED the overspeed and length of time are reported in writing in the aircraft forms! Otherwise, you see, the next pilot of that aircraft may not be around to answer for his (?) errors. The same example is painfully true for hard landings.

Enter aircraft discrepancies to be as required!

If you are on the other (maintenance) side of the fence, cause them to be corrected and removed as required!

Rule No. II. MANAGE AIRCRAFT FUEL AND OIL SERVICING WITH ACCURACY, AND INFINITE DETAIL

Every aircraft that you fly will burn fuel and oil. An oversimplified statement? Perhaps not. An observation airplane has a ten-quart oil capacity. If the engine burns three quarts of oil an hour, can this airplane complete a 4-hour mission without servicing: Simply no; of course not.

Equipment log book forms 2408-12 and -13 require that certain entries be made by the pilot in command. THESE ARE FOR OFFICIAL RECORDS! Specific entries are required each time aviation fuel or oil are added or emptied. Your professional aircraft maintenance brother needs to know rates of consumption in order to be *his* brother's keeper. Each pilot has the personal responsibility to check, maintain and make record of fuel and oil quantities in his aircraft.

Rule No. III. ENSURE THAT MISSION ESSENTIAL EQUIPMENT IS IN OPERATION

Every Army aircraft must have air-ground radio equipment on every mission. Aviation electronics (avionics) equipment must then be considered essential to *all* missions.

You plan a flight (VFR) into visual meteorological conditions (VMC). The best laid plans of mice can, as it were, come altogether unglued. At the point of no return between here and Outsville you discover yourself in the middle of something very much akin to thick chicken soup. What does A, for Able, do now? First of all, *climb; do not descend!* Climb out of trouble, like clouds with rocks in them and make a 180°. *But,* is this the time to discover that the VOR and ADF equipment doesn't operate? Again, a simple no.

The sample problem in the preceding paragraph can well be applied to all mission essential equipment, such as bomb racks, weapons, side looking airborne radar, etc, etc, *and the pilot!*

MISSION ESSENTIAL EQUIPMENT, MEE—sounds like me! Of this equipment, the brain and nervous system are the most essential. Pilots should be tiger-like officers to lead and command but the key to success is RELAXED VIGILANCE:

Relaxed in mind, body and spirit.

Vigilant in respecting certain dangers and hazards.

Lt Col Hochella is presently assigned as Airfield Commander, Libby Army Airfield, U. S. Army Electronic Proving Ground, Fort Huachuca, Ariz.

Be a Professional

Lieutenant George H. Seaberg

IN FEBRUARY of this year I was piloting a CH-21, hauling several passengers from Hanchey Field at Fort Rucker. Toward the end of the flight I noticed a slightly overboosted engine. Normal maximum for a CH-21 overboost at 2500 rpm is 46.5 inches manifold pressure. The helicopter read 47 inches at 2500 rpm for 5 seconds.

At the end of the flight the necessary inspections were performed by the maintenance personnel, and the aircraft was test flown for 15 minutes. The CH-21 was then released for flight.

An instructor pilot and his transition student took the next flight. Before flying the ship the IP examined the records and noticed the written up overboost. Even though the helicopter had been cleared for flight, the IP did not feel completely at ease. So, during the flight he was even more aware of possible forced landing areas than usual.

The new crew had been flying about 30 minutes when, on a takeoff, they noticed a series of rapid backfires from the engine and a loss of rpm. The IP took the controls and entered autorotation. Because he had been made aware of an overboosted engine, he was prepared to execute a forced landing into a cleared area. The engine had failed at about 100 feet above the ground.

This incident cost $11,000 for replacement of the blades. Without a written entry in the -13 the aircraft could have been a total loss. If the failure had occurred at night, two lives could have been lost. If an overboosted engine is written up, the aircraft is grounded for night or IFR flights for 10 hours according to Fort Rucker policy.

Frankly, I did not think an engine overboosted once or twice, as was this case, could cause an engine to fail. My former beliefs were quickly shattered by this experience—unless this same engine had been overboosted before and the responsible pilots had been so thoughtless, and supposedly embarrassed, as to "forget" to write down these mistakes.

The person with the professional attitude realizes that it is possible to damage an aircraft with no visible evidence of the damage; that these unseen damages *must* be noted on the aircraft history; and that by being "forgetful" he can kill someone, perhaps a good friend.

Lt George H. Seaberg is assigned to the Chinook Section, Dept of Maintenance, USAAVNS.

If all of MEE is operating properly, mission success is all but guaranteed.

Rule No. IV. RECOGNIZE THE HAZARDS OF TAKEOFF AND LANDING OPERATIONS

Pilots in the U. S. military system are exposed to excellent training. They are most alert during takeoff and landing. The instructor pilot represents the key to the go/no go door of aircraft qualification, and his experience is sound.

However, a large number of aircraft accidents still happen during takeoff and landing. No checklist can replace the judgment and ability of the pilot, but what happens when judgment and ability are clouded?

Let's make an assumption for purposes of examination: a sane pilot, Lieutenant Floof, is alert and knows his aircraft, but twice successively aborts—a takeoff, and then on his next flight knocks the gear off. Why?

Assumptions worth considering:

TAKEOFF

Hazard

Distraction, worry

Solution

Many people/things cause distraction and worry; some may be valid, some not properly to be considered. Sweep away the "clouds" and change the attitude. Be a lover, not a fighter, when in the pilot's seat.

LANDING

Hazard

Fatigue

Solution

Proper rest every night. Perk up, get "on your toes" when planning and executing landing operations.

While a large transport or bomber may take off and land once in ten hours, our aircraft

may perform ten such operations within one hour, and not always on a wide, "l-o-o-ong," smooth runway. We must be aware of the hazards involved. A couple of the more important hazards are cited in the example. Inventory and avoid all of them.

Rule No. V. USE CONSTANT CROSS-CHECK OF FLIGHT AND POWERPLANT INSTRUMENTS

Keep your head out of *and* in the cockpit. When on the gauges, cross-check external features of the aircraft, such as icing and lighting. When the sky is blue yonder, keep yourself clear of other air traffic, but remember, all instruments on the panel, all switches, rheostats, and dials are there for good reason. Read the fine print (RTFP) properly and often. Oil pressure reading consistently normal on cross-check is one thing. To find that it has suddenly dropped or that it is fluctuating rapidly on the high side may indicate trouble. Discover it early and your problems may only be little ones.

Rule No. VI. ALWAYS KEEP A FORCED LANDING SITE-PLAN IN MIND

I think it logical having covered Rule No. V that we discuss procedures in case of engine failure. We always want the crew back at home base, and if practical we want the equipment back. You are out of your element in the air; you may be forced to land now! Keep the aircraft under control at all times.

Were you ever called upon to execute a forced landing successfully without a good landing area in sight? Paul Mantz, a properly daring and famous American pilot, put it this way: "Why fly over terrain a mountain goat can't negotiate, when a few minutes diversion from your flight path will provide better forced landing terrain."

Review all aircraft emergency procedures, even the seldom thought of or used variety, such as fire in flight. Pilot dry-run time in the cockpit is invaluable on this last score. When you know and practice proper emergency procedures and techniques you will be more inclined to use them when required.

Of course, things are different when night falls. Unless you have a definite landing area in sight and range, hit the silk. In helicopters, become expert in the manipulation of landing and search lights; having picked a spot, autorotate to touchdown as close to zero groundspeed as the situation allows.

Rule No. VII. PLAN AHEAD OF EACH MISSION

Have you noticed the beauty of flight planning data organization on Aircraft Clearance form, DD Form 175? For example:

Point of Departure
  Where do I start?
Base Name of Destination
  Where am I going?
Mileage, Nautical
  How far is it?
Estimated Time of Departure
  When do I leave?
Estimated Time En Route
  How long a mission?
Transmitting Frequencies
  With whom do I communicate?
Pilot's Last Name
  The man in command of the machine.
Fuel on Board
  Will I make it?

May we pause here to note that the time-distance formula was applied early in the flight plan. Time equals distance divided by rate. Too basic, you say? Then why do we all too regularly and frequently miss estimated times of departure and estimated times en route or estimated times of arrival? There are some good reasons why Army aircraft missions get delayed beyond ETDs and pilots miss ETEs and ETAs. There are more good reasons why they shouldn't. Paramount on this side of the fence is our Department of Army assigned mission: *immediate response to the needs of command.*

Army Aviators should be expected to meet ETDs within plus or minus 5 minutes. ETAs should be met within plus or minus 15 minutes. Towers and FAA Flight Service will honor the usual requests for en route changes of flight plan. When working with FSS, pilots should record the name of the station, time and initials of the operator.

As another point in planning and making mission success easy to attain, all Army aircraft missions should be directive in nature. To further mission orientation, all aviators should be designated to remain current *only* in certain available fixed and/or rotary wing aircraft as appropriate. It is only logical in command planning to consider the consequences of one aviator retaining currency in five fixed wing and four rotary wing aircraft during any one period of time.

I will close this seventh rule with the shopworn but still very true six P's: Proper Prior Planning Prevents Poor Performance.

These then are my rules. Others may be as important to you. As a minimum, however, these should be your rules, not singly but applied simultaneously. Like a house made of playing cards, total success depends upon each individual member. Remove one member and the entire structure will collapse. Let's have no collapse in your individual operation.

FRAGILE
HANDLE
WITH
CARE

a fragile vase gets tender loving care, but what about our aviators?

James E. Coleman

A LIGHT AIRCRAFT overshot the runway during landing and came to a stop in a drainage ditch. Witnesses rushed to the scene and found the aircraft intact, but the pilot was slumped across the instrument panel—dead. A week later at another airfield an aircraft was demolished during a crash landing. Spectators were amazed when the pilot emerged from the tangled wreckage and walked away with minor abrasions.

How do we explain these two extremes in injuries? Why did the pilot die in the least damaged aircraft? Why did the pilot survive in the demolished aircraft? We have all heard such remarks as, "It was just a freak accident," or, "I guess it wasn't his time to go!"

AvSER's UNIQUE ROLE

Despite such popular beliefs it is not always fate that determines whether a pilot will live or die. More often it's aircraft design. This is the premise of Aviation Safety Engineering and Research (AvSER), Phoenix, Ariz., a division of Flight Safety Foundation.

AvSER's role in aviation safety is unique. Their primary interest is not what caused the crash—but what caused injury and death as a result of the crash. They strive to find out *what* equipment in the aircraft failed, *where* it failed, and *why* it failed. Recommendations are then made to manufacturers and military users to prevent such failures. The intent is to save lives—possibly yours.

Aside from crash injury investigations of civil and military aircraft accidents, AvSER gathers research data by deliberately crashing test aircraft. Some have been dropped from cranes speeding down the runway to simulate crash conditions.

One CH-21 operated by remote control was carefully flown into the runway at a prearranged speed and angle. Special dummies were instrumented and seated in various locations on different type seat structures. There were also two dummy litter patients aboard. Six high-speed cameras and extensive instrumentation recorded what happened during the crash sequence.

By determining what happens to materials and "human bodies" during crash impacts, AvSER is able to recommend improvements in design, restraint systems, and materials.

Discovering that castings holding certain aircraft seats were brittle and subject to breaking away at impact, AvSER replaced the castings with simple metal straps and found that the straps stretched slightly during impact, *but held instead of breaking at the same force.*

Not as simple as they may seem, seat structures require a whole series of considerations. First, the seat belt and shoulder straps attached to the seat must be strong enough to resist breaking during a crash. Second, the straps must be properly secured to the seat, which in turn must be properly secured to the floor, which must be properly anchored to the fuselage. This concept goes back to the old saying that a chain is no stronger than its weakest link. If the seat rips from the floor, or if the floor comes loose from the aircraft

The pilot died in this harmless looking early vintage Army aircraft. Cause of death was the pilot's head striking the 4-inch windshield when the gear collapsed during landing roll.

structure, the seat and shoulder harness are not much help. AvSER recommends, where possible, fastening of restraint devices directly to the basic structure of the aircraft. This would eliminate the problem of unduly heavy seat structure.

It is interesting to note that the first known seat belt reportedly used was in an Army aircraft in 1910, after Lt Benjamin D. Foulois nearly fell out of Army flying machine No. 1. When he landed, he rigged up a belt to hold him to the seat "during all conditions of flight." As aviation experience grew, it was learned that occupant restraint also played an important role in injury prevention.

Hugh De Haven, founder of AvSER, became keenly interested in injury causation after surviving a midair collision. When he left the hospital, De Haven took a desk job which included handling paperwork related to aircraft accidents. He detected two interesting trends: (1) a highly localized pattern of injuries similar to his own, and (2) the degree of damage to the aircraft did not necessarily dictate how severe the injury would be. People were killed in relatively undamaged aircraft, while others survived accidents in which planes were virtually destroyed.

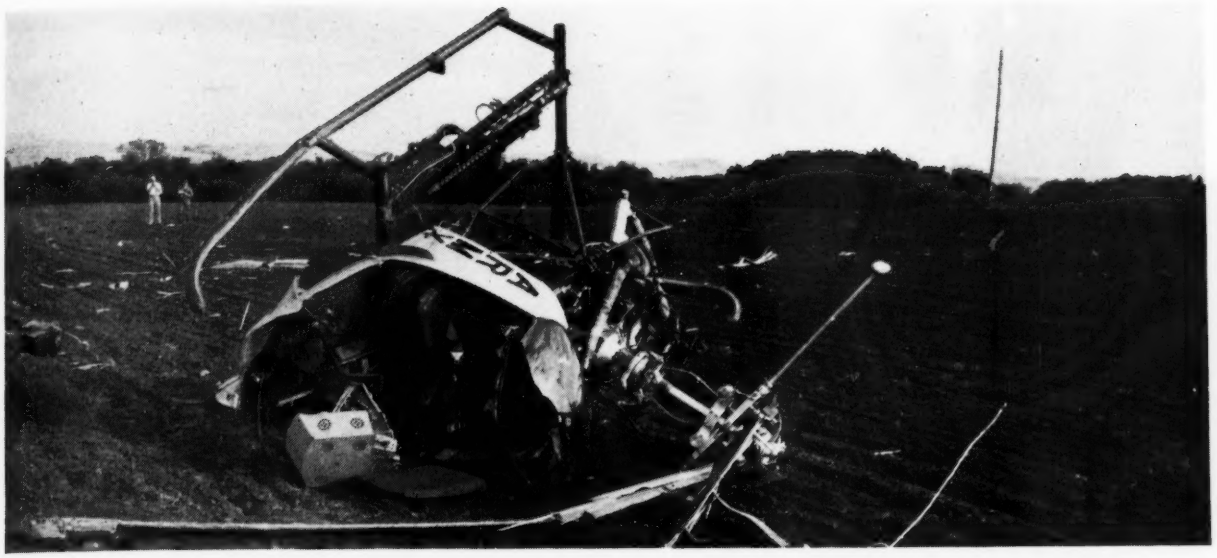
His observations led to the belief that crash forces reaching the pilot were influenced or governed by the characteristics of the aircraft.

He studied the ability of wings, landing gear, and other structures to absorb energy. Why wouldn't an intensive study of accidents reveal the nature of lifesaving characteristics which could be built into future planes?

Even though no one gave serious thought to his idea, De Haven continued to plug away. He was fascinated by reports of people falling from great heights and sustaining little or no injury. Why couldn't these experiences be applied in some way to crash injury research? He investigated a six-story fall made by a woman in a suicide attempt. This woman jumped from an apartment house window and landed in a flower bed. As the crowd rushed forward to view her remains, she raised herself on one elbow and said dejectedly, "Six floors and not even hurt!"

De Haven figured the gravity increase in this fall was approximately 140 g. His investigation revealed that the subject fell into the soft, loamy flower bed with her weight distributed evenly across her back, leaving approximately a 4-inch indentation in the soft dirt. If she had struck concrete, she would have died instantly. This followed another old saying, "It's not the fall that kills you, it's the sudden stop."

De Haven's data on a number of such free falls by humans who survived was in sharp contrast to some aircraft accident victims who succumbed to forces of considerably lower magnitude.



Two walked away from this demolished OH-13 after it struck a wire and plummeted into plowed field. Both occupants were wearing seat belts and harnesses. Their only injuries were shoulder harness burns and minor cuts and bruises of the legs.

Though now retired, De Haven's early work was recognized and is paying dividends through the AvSER group at Phoenix. Their research over the years has been made available to manufacturers. The picture has become brighter in recent years as these manufacturers have begun to realize that inadequate safety equipment is hardly better than none at all.

But there is still a great need for education of the public to the advantages of safety engineering in aircraft. If all of AvSER's recommendations made to date were incorporated in aircraft, an estimated 40 percent of the fatalities in so-called survivable crashes could be avoided.

AvSER offers a two-weeks crash injury investigation course to selected Army and civilian aviation personnel. The word "crashworthiness" becomes a byword to students during this course. Crashworthiness is described as "the capacity of an aircraft structure to serve as a protective container during potentially survivable impact conditions."

What good is a seat in an aircraft, an AvSER instructor asks, if it breaks away from an intact floor during a crash? There are many examples where crew members and passengers have been hurled forward during a crash, *still strapped to their seats.*

AvSER compares the aircraft passenger to a fragile vase. When you pack a vase for shipment, you surround it with *insulating* or *shock-absorbent material* and place it in a *sturdy box* to ensure its safe arrival. AvSER believes this same theory applies to the "packaging" of occupants in an aircraft.

Visual Error in Rain

IN ADDITION to poor visibility when flying in rain, there is a refraction error in vision. Two reasons for this refraction error exist: the reduced transparency of the rain-covered windshield, which causes the eye to indicate a horizon below the true horizon; and the shape and pattern of the ripples formed on the windshield, which cause objects to appear lower. Either or both of the above can cause an error in angle of approximately 5°. Thus, an object one-half mile ahead of the aircraft could appear to be 200 feet lower than it really is. This theoretical possibility could become a hazard during a circling approach or on final approach to landing. It would be interesting to know whether any Army Aviators have experienced such difficulty.

THEN & NOW

Captain Darrell D. Jurling

Aviators will not wear spurs while flying . . .

THIS HUMOROUS quote from regulations for aviators published in 1920 is not quite so funny if you consider the situation as it existed in those days. Most aviators had just graduated from the cavalry and were reluctant to discard their spurs. But after a few accidents caused by the wearing of spurs in the cockpit, the rule was made.

In January 1920, some 75 regulations for aviators were published, entitled "General Rules—to be Followed at All U. S. Flying Fields." Today most of them sound strange and unnecessary, but they were published as a result of experience factors much the same as regulations are today.

The curious thing about these old rules is that some of them are timeless and apply today as much as they did 43 years ago. Let's look at just a few and compare them with recent accidents/incidents that could have been avoided if these old rules had been followed.

Don't take the machine into the air unless you are sure it will fly.

The pilot of an 0-1 attempted to apply full power after dropping a message. The engine failed to respond properly and the aircraft struck several trees. Later investigation revealed that the pilot, as well as most of the other pilots and crew members at the field, knew this particular airplane was not functioning properly. None of them, however, had written it up on aircraft form 7801-13.

In taking off, look at the ground and the air.

An 0-1 struck a haystack during takeoff. The pilot stated he didn't see the haystack until it was too late.

Never get out of a machine with the motor running until the pilot relieving you can reach the engine controls.

A CH-34 lifted off from its pad when the pilot climbed into the cockpit from the passenger compartment. The engine was running at the time and the rotor blade was engaged. The pilot's clothing caught the pitch stick, causing the aircraft to lift off.

Pilots should carry handkerchiefs in a handy position to wipe off goggles.

On a dark night, two 0-1s were being readied for a radio relay mission. One was accidentally

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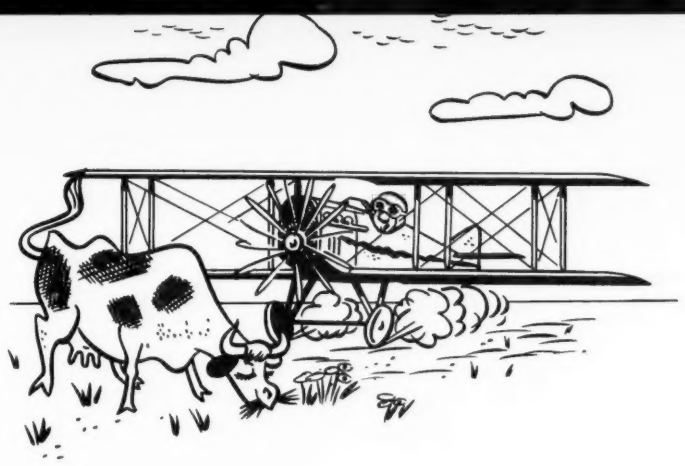
Capt Jurling was a student at the University of Southern California Safety Course when he wrote the manuscript on which this article is based.



taxied into the rear of the other on the runway. An investigation discovered that moisture condensation on the inside of the windshield prevented the pilot of the rear aircraft from seeing the other.

In case of engine failure on takeoff, land straight ahead, regardless of obstacles.

Immediately after takeoff an 0-1 engine failed. To the front was approximately 500 feet of runway plus 1,000 feet of sod overrun. Instead of landing straight ahead, the pilot elected to make a 180° and land downwind. Result: major damage to aircraft.

Learn to gauge altitude, especially on landing.

U-1A landed hard, buckling fuselage and damaging tail wheel bracket.

If you see another machine near you, get out of its way.

While practicing touch and go landings a U-6 crashed into trees during an attempt to miss another aircraft at the far end of the strip.

Never run motor so the blast will blow on other machines.

A CH-37A hovered over parked 0-1s and downwash buckled the wings.

Before you begin a landing glide, see that no machines are under you.

OH-13H crashed during approach to road. Vehicle moved into road as aircraft approached touchdown point. Pilot overflew intended touchdown to avoid vehicle, and main rotor blades struck tree.

Hedge-hopping will not be tolerated.

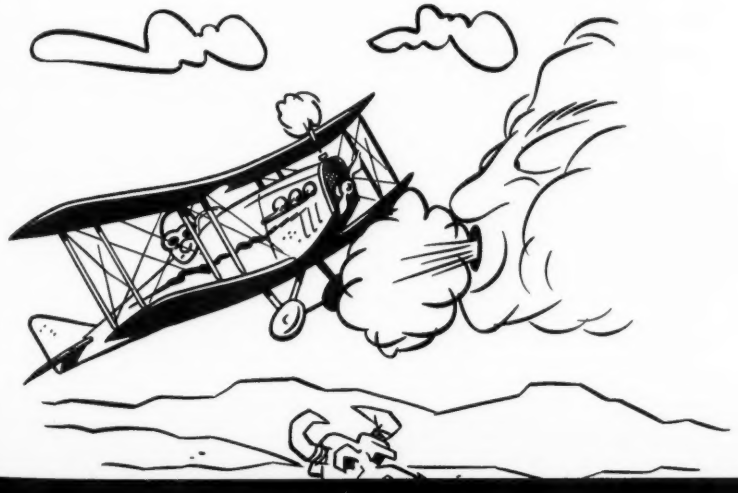
UH-19D struck cactus plant with right front landing gear during attempted climb over small ridge. Result: incidental damage to landing gear.

If flying against the wind, and you wish to turn and fly with the wind, don't make a sharp turn near the ground. You might crash.

UH-19 turned downwind, lost translational lift, hit on right main gear, then crashed on its side.

Don't attempt to force machine onto ground with more than flying speed. The result is bouncing and ricocheting.

U-6 landed long, skipped and bounced, and went off left side of runway, striking main rotor blade of parked UH-19.



You must not take off or land closer than 50 feet to the hangar.

CH-34C tail rotor struck lean-to during landing. Major damage to tail rotor blades and one main rotor blade.

Never take a machine into the air until you are familiar with the aircraft and its controls and instruments.

On a routine flight, the passenger in an OH-13H stated he had had some time in flying this type of aircraft and expressed a desire to fly it. The pilot relinquished the controls to the passenger. The passenger attempted an approach to a helipad and misjudged his altitude. The aircraft came in contact with the ground with a slight tail-low attitude, bounced and turned 180°.

Joy rides will not be given.

OH-13E took off while mechanic was standing on right skid. Aircraft turned 270° to right and main rotor blades struck ground on right side.

Things have not changed much over the years. The old basic safety rules still apply. We don't have as many accidents as aviators had years ago, but then we are also a lot better trained for the job of flying. However, we still seem to have a number of novice type accidents.

Perhaps it would help if we added one rule of our own. This rule should go something like this—"Let common sense, experience, and good judgment be your guiding light."

A STRANGE THING HAPPENED ON THE WAY TO SPAIN

Captain Robert S. Borer

The following story is based on events which actually happened. The locale is Stuttgart AAF and various other points on the continent of Europe. The cast is composed of members of an Army Aviation detachment. The moral of this story—well, you decide.

* * *

A telephone rings. From the conversation which follows, it appears that the aviation detachment has been assigned a mission to transport an officer to Spain in a U-6A for an investigation. Two intrepid aviators volunteer. The operations officer is overwhelmed by their devotion to duty. (After all, five days TDY to Spain with per diem is no picnic.)

The flight is planned, necessary equipment is gathered, and maintenance is advised to have the aircraft completely refueled, *with tiptanks,* and ready for an 0900 takeoff. Then the intrepid aviators retire to brush up on their high school Spanish.

Next morning, in the busy weather station, the two aviators experience much difficulty in finding a refueling stop and an alternate airport for this stop. It appears that Mother Nature has played a cruel trick. Most of the continent is covered by an inversion which is keeping low ceilings and visibilities over almost all available airfields. Above 3,500 feet one can see 100 miles. Finally, an airfield is selected which is forecast to be down to minimums (the best they could do), and an alternate is picked which stretches the fuel to the allowable limit (once again, the best they could do).

Later, on the flight line, the aviators are busy preflighting the aircraft, checking to see if all necessary equipment is aboard, and questioning the crewchief to ascertain that the ship has been completely refueled.

"Were the tiptanks filled?" the crewchief is asked. "Yes sir," is the reply. The main tanks are checked visually, and fuel is drained from the sumps of the tiptanks. Since fuel comes out of the tiptank sumps, there is no question in the minds of the aviators that they are full. (After all, how many of us ask for a ladder to personally inspect the tiptanks when our weather briefing void time is expiring and we are told by the crewchief that he was there when the tanks were filled?) Also, the maintenance NCO states that he was there when they were filled, even though it was late in the evening when the ship returned from a flight. The NCO reminds the pilots that the front fuel gauge is inoperative.

After receiving their IFR clearance, the pilots take off into a gloomy overcast that can only be appreciated by persons who have flown in Europe. At precisely the altitude that the weather people had predicted, they break out into blinding sunshine with visibility unlimited. Without a front fuel gauge to rely on, the aviators had to establish an alternate method to determine when to transfer fuel from the tiptanks. It was decided that they would fly for one hour, then transfer for 15 minutes, then fly for another hour, then transfer for 20 minutes, then fly using the remainder of the rear

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Capt Borer is assigned as safety officer to the 505th Signal Group, Stuttgart, Germany.

tank, center tank, and finally front tank if necessary.

The first hour goes by; the fuel transfer is accomplished, and flight is continued on the front tank. Checkpoints fly by, as only they do in a Beaver. The aviators are awed by the magnificent scene before them, a solid blanket of white below, broken only by the far-off Alps protruding above the seemingly unending clouds. Talk is exchanged about the possibilities of the forthcoming few days.

Suddenly, after approximately 2 hours of flying, *the engine quits.* The friendly banter in the cockpit stops.

The engine was restarted by shifting fuel tanks, and cruising altitude was regained. Then the mental cogs began to turn. Was there enough fuel? To reach the refueling stop, yes. To reach the refueling stop and then to the alternate, no. Their reasoning indicated that no fuel had been derived from the tips and none could be expected. Weather was checked at the refueling stop, by asking ATC. Once again, the judgment of the weather people was right. The field was indeed down to minimums for the Beaver. With nowhere else to go, flight was continued to the refueling airfield. Never has an approach chart been studied so hard as that one during the next few minutes. The approach was successfully made, and this story has a happy ending. The tiptanks were visually examined after landing and were *bone dry!* WHAT HAPPENED?

The remainder of the trip was uneventful, that is if you are used to flying IFR in Spain. No habla espanol. The tiptanks functioned normally throughout the rest of the trip.

Needless to say, upon returning to home station questions were asked. The persons, who before the flight started were so adament about the tiptanks being full, were still sure that they personally were there when they were filled. Then events began to unfold. The aircraft had returned just at dark the evening before the flight. The aircraft was refueled. Then the crewchief went to the movie. After the movie the aircraft was moved into the hangar. The flight which had returned late had been a long one and tiptanks had been used.

By now you are probably beginning to form some conclusions as to what happened. This is what we think might have happened:

On the long flight the day before, on which tiptanks were used, after the final sequence of draining the tiptanks the fuel exchange handle was left on BOTH. This was overlooked by the crewchief before refueling. Refueling was accomplished. Personnel departed to the movie. The fuel in the tiptanks drained, by way of the overflow, onto the ground. Because of the dark and the time already elapsed when the aircraft was later moved into the hangar, the evidence of the drained fuel was unnoticed. Enough fuel remained in the tiptanks to provide a small reservoir, so when the sumps were drained the following morning fuel came out. This is our consensus.

What do you think happened?

Here's a few Mohawk operational tips from a pilot who has been with the aircraft since its first flight in 1959. They are offered to save you some "learn-the-hard-way" experience and to increase your understanding of the ship. The more you learn about the why's and wherefore's of the Mohawk, the more professional you'll be—and who doesn't want to be an "Ole Pro"?

How to Get Mor

DURING MY association with the Mohawk program I have developed several techniques of operation that seem to have merit in getting more out of the Mohawk.

Let's take first things first and get our little jewel cranked up and ready to move.

Being an internal combustion engine, it requires rotation, fuel, and fire to function.

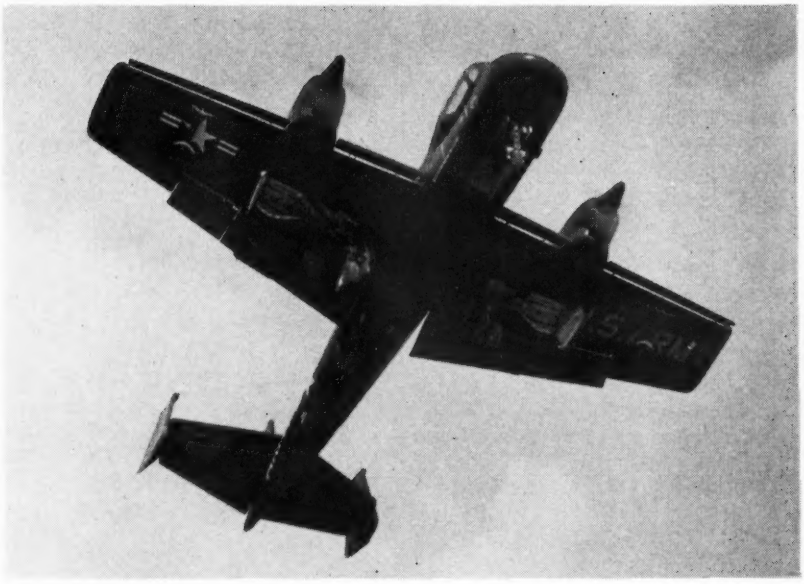
Before giving it any of these, let's see that everything possible is turned OFF to make it easier on the battery. Get everything possible done before turning on the battery. This would include fuel ON, throttle IDLE, engine master switches ON, etc.

When finally ready, turn ON the battery and crank the starter. Wait until 9-10 percent rpm is attained and then hit the "zippo." Do this intermittently and stop as soon as a positive rise in EGT (Exhaust Gas Temperature) is noted. [Starting procedures vary slightly with engine model.]

Although several gauges should be checked during the start, the primary object of your attention should be the EGT. In the case of a hot start, remember, there is one and only one way to positively stop the rise in temperature (and this will work every time): shut off the fuel. This makes it simple: one thing to watch; one thing to do.

O.K. We got that one going, so let's think about the second. First of all remember how long the battery was working. It's a bit tired; so run up the live engine to at least 60 percent and if the battery is really tired, 70-75 percent.

Now crank the second and get the live generator on the line as quickly as possible. On early aircraft it will be on the line; on aircraft with the generator assist button, push the button as you



Out of the Mohawk

Ralph Donnell

intermittently apply ignition.

Now that we have both engines turning and have saved the battery, let's focus our attention on saving the prop aux pump. If the basic engine is at Ground Idle, the pump has to be energized for 4-6 seconds to unfeather. At Flight Idle, this is 2-3 seconds; at 70 percent rpm, only about 1 second.

The only other times that the aux pumps run are for feathering and reversing. There is no way to shorten the feather time, but reverse time can be shortened by only using them for landing and testing, instead of during taxiing as well.

While we are in a saving mood, let's save brakes by feathering one prop while taxiing. If the bird has nose-wheel steering, this will keep taxi speeds proper without using the brakes.

While we are on the subject, remember the first time you drove a car with power steering and power brakes? Overcontrolled both, didn't you? Well the Mohawk has both, and the tendency to overcontrol will be there until you get acquainted.

TAKEOFF

Now for takeoff. Check complete—all switches, knobs, wheels, cigarettes, lighter in their proper places. Look at the top engine gauges—torque. The bird has torque, two sources, both want to make you turn and roll left. With nose-wheel steering and dry runway, no problem, drive away. Without nose-wheel steering or on a slick surface, let's get ahead of the bird before we start to move.

We know that no two engines will accelerate the same from idle, but all are very close from a cruise power. O.K., so let's hold brakes to cruise rpm on both engines before advancing to takeoff power.

Torque is going to turn us to the left. So either add a bit more power to the left engine before jamming and/or point the aircraft a bit to the right and let torque turn the aircraft straight.

Mr. Donnell has been Mohawk Project Pilot for Grumman Aircraft Engineering Corporation since April 1959. He has over 5,000 flight hours, more than 650 hours in the Mohawk.

Right rudder and right stick do the rest.

Takeoff: If the stick is held full back through the takeoff roll, the aircraft will get off the ground in a minimum ground roll, BUT it gets off the ground at just above the 1.0 g stall speed. By definition, no more than 1.0 g can be pulled at this speed so it is not going to be possible to rotate the aircraft nose-up to climb until more speed is attained. A cleaner takeoff is accomplished by getting this speed first and then rotating sharply. It's also *much* smarter in case one of the fans quit.

The only time a stick-back takeoff run is the best is in rough or soft terrain. In this case the stick should be back to get the weight off the nose wheel. Otherwise the nose wheel creates a bow wave of debris that can hit and damage a prop.

LANDINGS

Landings: These can be put into two categories: normal and max effort.

On a normal landing—well, make just that. Sure it's fun to stop quickly, but why, if it just means adding power to get to a turn-off point on the runway? It's easier on the props, engine, brakes, ears, etc., to just pull to Idle and let her roll on out. A gentle but steady use of the brakes is better than intermittent hard application.

If you want to use reverse, fine; but even if only Idle reverse is desired, go all the way into full reverse lever position and then back off to Idle. This way, both will reverse at the same time, even if the micro switches are not matched in their adjustment.

A maximum effort landing requires full reverse thrust right at touchdown or as soon as attainable after touchdown. Engine acceleration is a big factor in this. If at Idle you are many seconds away from full reverse thrust, but if at 70-75 percent rpm (N_1) it can be had in just a couple of seconds. So, hold your power right to touchdown and then get to full power in reverse as soon as you can. *Now*, before you stop, *ease* off the reverse power and let the gas producer wind down to Idle with the props still in reverse pitch. Then, when all is calm, push the power levers down to Ground Idle (forward thrust) and drive away.

While on the subject of reverse thrust landings, let's talk about the erosion of prop blades in reverse. As you can tell by looking at any Mohawk prop, they get sand blasted. The sandier the terrain, the more the erosion. Now what can be done to reduce this? On a landing in a dirt field or road, the last few feet of a max effort reverse thrust landing are under IFR conditions. This can be eliminated by using full reverse on touchdown. Reduce reverse thrust to Idle power earlier than usual and come out of reverse before a complete stop has been made. Even on a runway, there is enough sand and grit to do a pretty good job on props, even though the sand is not visible. Thus, if it is not necessary to make a minimum distance landing, easing off the power a little sooner and coming out of reverse before stopping will save props.

LIMITATIONS

By this time we have extended the lifespan of almost every part of the aircraft except for the nut that holds the stick, and this one piece of equipment can use an extension.

Proper use of the equipment will be the biggest step in this direction. To use it properly, it has to be completely understood and its limitations known—not only the airplane's limitations but your own as well.

The airplane itself is capable of a complete routine of aerobatic maneuvers; in fact, all of those that could be done by a World War II fighter plus a few of its own. It is also quite forgiving to the aviator who makes mistakes in aerobatics, *except when trying things at too low an altitude*. Practice your maneuvers up high where there is space to correct for errors.

Earlier it was mentioned that

the T-53 is an internal combustion engine. Although this is basically true, there are some different characteristics between the turbine and reciprocating engines. Its acceleration time is the most obvious difference. This slower acceleration is no problem if you just stay ahead of the machine. Don't get into a spot where you have low rpm and a possible need of power quickly. This slow acceleration can also cause a bit of difficulty in the Autofeather circuit. This circuit is activated when three conditions have been met:

- arming switch ON,
- torque below 10 psi, and
- throttles *full* forward.

Either on the ground or in flight these conditions can be met easily without an actual engine failure. The most obvious time for this to occur is on a touch-and-go landing—low power at landing, torque below 10 psi and then a throttle jammed full forward. To save embarrassment of making an unexpected turn off the runway, a worthwhile habit is a two-step throttle advance. Push forward anywhere from ¾ throttle to Mil. power detent and save the last bit until the torque is above 10 psi. This can be determined by either observing the torque gauge or just waiting until you feel the power build up. Then go to full throttle. This *won't* cost you anything in time to get power on, since the engine accelerates only as fast as the fuel control will allow and is not concerned with how fast you move the throttles. As long as you are ahead of the acceleration the time will be the same.

PERFORMANCE

One characteristic that is not so obvious but just as important, is the effect of altitude and temperature on performance.

Comparing the T-53 with a piston slapper we find that the recip has the same takeoff power from sea level up to a critical altitude. For example, at 2,400 feet on an R-1820-82. In the next 7,000 feet the same engine loses 21 percent of its takeoff power.

The T-53 starts losing power as soon as altitude increases and loses it at a rate of about 1.7 percent per 1,000 feet or a little more than 16 percent of total power up to the same altitude that the R-1820 had lost 21 percent.

Mark one up for the turbine.

Temperature effect: The R-1820 will gain 1 percent in power for each 10° C drop in temperature below Standard Conditions (15° C). The T-53 will gain 5 percent in power for this same temperature drop below normal 10° C.

Mark two up for the turbine.

But—the temperature effect is a straight line function. Both engines *lose* the same 1 percent vs 5 percent power for each 10° C *increase* in temperature above the Standard. It is not too hard to see that a hot day could make you sweat an obstacle that would be no problem on a cool day.

Last, but by no means least, is the Martin Baker seat. The October 1961 issue of the U. S. ARMY AVIATION DIGEST has an article that covers the Martin Baker seat in considerable detail and needs no repeat.

Suffice to say that you should really know this chair thoroughly—not only so that you won't depart inadvertently but so that you will depart on schedule if you have to.

Have a plan. Know what will dictate when you stay with the machine and know what will cause you to leave. Then, when you know that you are leaving, do so with dispatch and dexterity.

I am sure there are many other ways to save in this machine and probably better approaches to some areas than the ways covered here. If you know of any or pick up any during your tour with the Mohawk, how about passing the info on—not only to your military type friends but to us defense workers as well. It might save us trouble in the future.

It is not the intent of the author to supersede any U. S. Army operational techniques by this article. In many cases, field operational experience may well develop better techniques than are mentioned here.

another hitch on the parachute seemed appropriate...

Dead Reckoning

I WATCHED the ADF needle swing 180°. Don banked the Beaver gently to the left, then leveled the wings.

I pressed the mike button and spoke, "Blackstone radio, this is Army 5720. Over."

"Army 5720, this is Blackstone radio. Go ahead."

"5720 over Blackstone at three one; 5,000; instrument flight rules; South Boston, zero one; Greensboro. Over."

"5720, you are fading. Say again South Boston estimate."

"Estimate South Boston zero one; Greensboro. Over."

"Roger, understand South Boston zero one. Maintain 5,000. Blackstone alti . . ."

A red light popped on in my mind with explosive brillance. A quick glance showed the load meter indicated zero. The volt meter showed a drop.

I reached over and flipped the generator switch off and on,

This account was furnished by a member of the Communicative Skills class of the Army Aviation Safety Course, University of Southern California.

watching the load meter. It still read zero.

"Blackstone radio, this is 5720. Our generator is out. Please say again altimeter setting."

There was a crackling sound in the headset.

"Blackstone radio, we cannot read you. Will continue as cleared."

Don glanced over. "Better recheck that ADF. The needle seems erratic."

I turned the ADF volume up, but all we could hear was a slight hum.

"Blackstone radio, this is Army 5720 transmitting in the blind. Our navigation equipment is out. Will continue on course."

There was no response.

I checked the directional gyro against the compass. The letters VAC on the bottom of the gyro stood out in welcome relief. A quick glance at the suction gauge showed the vacuum system operating normally.

"I'll hold 245°," said Don. "Turn off everything we don't need. We'll need that battery later."

I turned off the radios. "What about the navigation lights?"

"Turn them off. We'll need them if we break out VFR."

Our forecast called for ground fog as far as South Boston, but Greensboro was supposed to have 3,000 feet broken. The wind at 5,000 was forecast at 15 knots from 330°.

Don continued holding 245°. The published heading to South Boston was 240°, but he'd added 5° for the wind after we turned the corner at Blackstone.

The airspeed indicator showed

124 miles per hour. Outside air temperature was −1° C. A quick calculation on the E6B showed an approximate true airspeed of 115 knots.

I leaned toward Don. "Hold your heading. We're making a groundspeed of about 118 knots. If we're lucky and the battery isn't too low, we should be able to get a fix at South Boston."

"Yeah!" grunted Don. He didn't sound too encouraged.

I suddenly remembered we'd figured 108 knots for this leg. I checked the flight plan to be sure. There it was: "Blackstone to South Boston, heading 240°, distance 54 miles, time 30 minutes at 108 knots. I set the new groundspeed on the computer and checked it against the mileage. Twenty-seven minutes—just within the 3-minute limit.

"Do you think they cleared the airways for us?" asked Don hopefully.

"I doubt it. Unless Blackstone caught our last transmission, they don't know we're running blind. Our next transmission is due in about 12 minutes. They'll know then."

"You figure we'll make our estimate at South Boston?" asked Don, his eyes glued to the instruments.

"I figure we'll be 3 minutes early, but it's a dead reckoning estimate."

I saw Don's knuckles whiten as he gripped the wheel. "Want to take a break?"

"Yeah, thanks," said Don. "What do you want me to do next?"

"Better figure how early we'll hit Greensboro. I expect we may have to throttle back or risk plowing into their traffic."

Don lit a cigarette and reached for the E6B. The ship flew on smoothly.

I felt Don's hand touch my shoulder.

"Looks like we'll be 6 minutes early at Greensboro. Maybe you'd better slow down after we pass South Boston."

I nodded. "What airspeed?"

"A hundred and five. And we'd better turn to 247°."

I looked at the clock. "We should be over South Boston in two minutes. How about turning on the omni and see what you can get?"

Don turned the omni on and a slight buzz came slowly into the headset. Nothing else. The OFF flag trembled slightly but that was all. He cranked the tuning handle slowly past the channel on either side. Nothing!

I saw the second hand on the clock sweep toward vertical. It was five seven, our ETA for South Boston. I eased the throttle back and retrimmed for 105 kt airspeed, then banked gently and picked up a heading of 247°. The aircraft felt sluggish and the wheel was slick with sweat from my palms.

A heavy silence crept into the cockpit over the roar of the engine. Twenty minutes—an eternity—went by.

I felt Don's hands on the controls. "Let me spell you awhile. You look like you need a break."

He was right. I released the controls and relaxed my cramped muscles. There was nothing but inky blackness outside.

Suddenly, there was a bump and another as we hit turbulence. Tension increased. The clock showed 7 minutes to go for our ETA at Greensboro. I wondered how we'd make the letdown without radio.

Don must have been thinking the same thing. He asked, "What do we do when we get there?"

"We'll have to let down to 2,300 feet, procedure turn altitude. Our only hope is to break out and recognize something to get a position." It was a sobering thought. Another hitch on the parachute straps seemed appropriate.

The blackness outside seemed to squeeze in. *Wait a minute! What was that? Probably seeing things, but it sure looked like something moved. There it was again.*

"Hey, I can see some stars up there—no, they've gone again!"

The air became more turbulent and occasionally the outline of the clouds was visible.

The minutes inched by. It was now three one.

Don glanced at the clock. "I'll start a procedure turn. We should have passed the airport by 3 miles if we are on time. The station was 3 miles southwest of the airport, if I remember correctly."

"Right!"

Don started a slow turn to the left and eased back on the throttle. My eyes strained into the blackness, watching for a break.

The altimeter passed through 4,000 feet as Don started his turn to the right. Sweat trickled into the corners of my eyes.

Don rolled the wings level on a heading of 030°, continued the descent for another minute, and leveled off at 2,300 feet.

All at once some lights flickered downward and to the left.

Don had seen them. "Watch the gauges," he shouted, "I'll try this hole. Turn on the navigation lights and don't let me get below 1900 feet!"

He banked sharply to the left and leveled off just under 2,000 feet. Our heading returned to 030° and the visibility was good, probably 8 miles.

The lights we had first seen drifted by and we spotted another town to the right.

Suddenly, dead ahead, was a flashing green and white beacon —Greensboro!

Army Aviation is called upon to perform many varied and unexpected missions. This account offers some cogent operational tips for all helicopter units.

IDA

Captain Louis L. Mizell

SHIVERING nights at 35° F, noonday lunch at a blazing 110°, takeoffs from the shifting desert sand and landings on mountain crags all in one helicopter operation pose problems —challenging but not insurmountable.

This was the environment confronted by the 421st Medical Company (Air Ambulance) operating in IDA (Iranian Disaster Area) as part of the Army Emergency Relief Operation undertaken after the disastrous 1962 earthquake wreaked devastation upon a 50 by 60 mile area of Iran.

The unit, represented by 10 Medical Service Corps aviators, 15 enlisted men, and six UH-1B Iroquois helicopters, was selected by Seventh Army to provide air support. Maintenance support was provided by a team from the 29th TAAM Company, also a part of Seventh Army.

ASSIST FROM MATS

Movement from Germany to Tehran, Iran, was by C-124 aircraft provided by MATS. The first problem encountered was loading the UH-1Bs. The UH-1A can be loaded by removing the main rotor blades and one tail rotor blade, but the UH-1B, with a 9-inch longer mast, must also have both the head and mast removed. Fortunately, despite the use of inexperienced personnel at the off-loading point, only one ship received damage (minor) to the tail boom when an attempt was made to move the aircraft with a skid tied down.

Upon reassembly, the helicopters were flown to Quazvin, where a base camp was established adjacent to the 8th Evacuation Hospital, which had arrived two days previously. An advance camp was later established 40 miles south, in the desert at Buyin, on the northern edge of the devastated area.

Although each officer was an experienced helicopter pilot, the situation required new techniques to be learned and a few, long unused, to be reviewed.

OPERATIONAL HAZARDS

A normal day usually began at 0530 and ended at 1830. The only break was at midday when the extremely high temperatures sent the density altitude soaring. The temperatures and elevation in the area of operation made it imperative that the early morning coolness be used to the maximum; therefore, the first light of day was scheduled as takeoff time. Night flying was not attempted since there were no lights for visual reference and no reliable navigational aids located in or near the area.

The base and advance camps were in the desert (elevation 4,000 feet); the area of devastation was a 60-mile stretch of mountain range, 50 miles wide, ranging in elevation from 4,000 to 10,000 feet. Temperatures varied from 35-40° F at night to 100-110 degrees at midday. Density altitude (which all pilots became proficient at computing) was 8,000-13,000 feet. Winds at midday were 40 to 60 mph in the higher elevations and subject to 180° changes within less than 30 minutes.

After flying in Germany, where temperature, wind, elevation and density altitude were no problem, the pilots had a tendency to approach the new area as they had their home bases. This attitude was short-lived, and thereafter all items were doublechecked before loading, takeoff, or landing.

Loads had to be drastically reduced, from the UH-1's normal 3,000 pounds with a full fuel load to a combined total of 1,500 pounds. Even with 200 extra engine rpm while landing and taking off, a loss of rpm was often experienced. However, the aviators felt no other aircraft in the field was capable of performing, in this particular area, as well as the UH-1.

Due to the varying degree of slope at most landing sites, wheeled landing gear would have been unsuitable. Landing areas were often small, mountain-side rice paddies barely large enough to accommodate the skid gear of the helicopter. (Here too, the rotor diameter had to be taken into consideration.)

An additional hazard in takeoffs and landings, requiring high proficiency, was the powder-like dust and sand throughout most of the area which prevented takeoffs from a hover. Takeoffs

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Capt Mizell is operations officer for the 421st Medical Company (Air Amb) located at Nelligen, Germany.

were from the ground. Once the power setting and attitude were established, they were held for the first few seconds. (All visual contact was normally lost in the dust.) For the most part, instrument takeoffs, though of short duration, were an accepted part of the takeoff maneuver.

Landings were somewhat less difficult when the approach was made shallow and to the ground. Because of the dust, running landings with little forward motion were required to enable skid contact before the loss of visual reference.

LEARNING FROM EXPERIENCE

The techniques described were perfected after an incident early in the operation in which a pilot, due to the dust created on takeoff, lost visual contact with the ground and pulled excessive pitch. This caused a loss of rpm and contact with the ground, resulting in a broken right lower section of plexiglass and a bent forward cross tube.

It is interesting to note, this aircraft flew more hours during the operation than any of the other five. The nose was patched with a discarded C-ration box and due consideration for the cross tube was taken on landings and takeoffs.

Since landing sites were on mountain sides, narrow ridges, in creek bottoms, or in small box canyons, they were reconnoitered carefully, with wind direction receiving special attention.

Pilot fatigue became a problem after the first few days of the operation. This is easily understood when you consider the aviators' daily schedule, and the altitude and temperature as compared to that of Germany where personnel were accustomed to flying.

A pilot and copilot were used when possible, but even under these conditions, advantage was taken of each refueling and loading stop to obtain a few minutes rest. This situation was later eased by sending two pilots, with an aircraft returning for maintenance, into Tehran on a daily basis.

Navigation was strictly by pilotage, and here basic map reading came in handy. Due to the nature of the terrain, a topographic map was a must. There was no problem in disorientation; however, familiarity with the topographic map and contour lines was necessary to locate and pinpoint a particular village or drop site. At times the maps were found to be inaccurate since some villages had been abandoned or built-up since the maps were published.

MISSION OPERATIONS

The mission itself, although basically medical, involved considerable air delivery of food supplies, clothing, blankets, and tents, since all of the victims' belongings had been buried under the rubble.

Several hundred small villages were in the area of operation; therefore, a systematic survey of each village was conducted. Initially, a team consisting of a doctor, corpsman or nurse, and interpreter were flown in. The team was left while patients were air-evacuated. On the next sortie, food was flown in and the team flown out. Based on their survey, successive flights were made to deliver needed items.

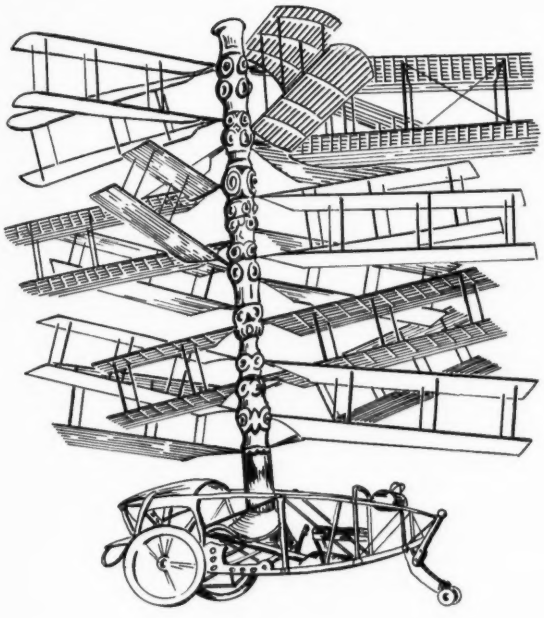
Obtaining supplies in sufficient quantity to ensure maximum use of the helicopters proved to be an unending job. All supplies were in the hands of organizations located some 100 road miles from the advance camp, where the supplies were needed for airlift into the remote villages of the higher elevations.

Fuel was delivered to both the advance and base camps by refueling tankers provided by the Imperial Iranian Air Force—one tanker each at the base and advance camps and one shuttling from Tehran (90 miles away) to replenish fuel in the other two. The only major problem encountered in this area was the lack of fuel for the truck and pump engines.

MAINTENANCE PROBLEMS

Maintenance, always a problem, was aggravated by the abrasive action of sand and dust. A lack of water prohibited washing; therefore, all lubrication points were cleaned and greased daily. However, this did not prevent wear to exposed bearing surface areas. Eventually all rod end bearings required replacement. (In this instance, a few small rubber boots that could be slipped back for lubrication, would have made the aircraft practically impregnable to dust and sand.) The maintenance problem was helped by sending one helicopter to Tehran daily, where hangar facilities were made available by the ARMISH MAAG Flight Detachment for more complete maintenance. Work could be performed here without the ever present dust creating such a problem. Normally four of the six UH-1s were available daily for operational use.

The mission was concluded after a period of approximately 33 days. There were ten wiser aviators, six EDP aircraft (due to the bearing surface exposure on all control rods mentioned previously), and an understanding of fellowship between the Iranian people and a handful of American soldiers who represented their country in meeting the needs of another people.



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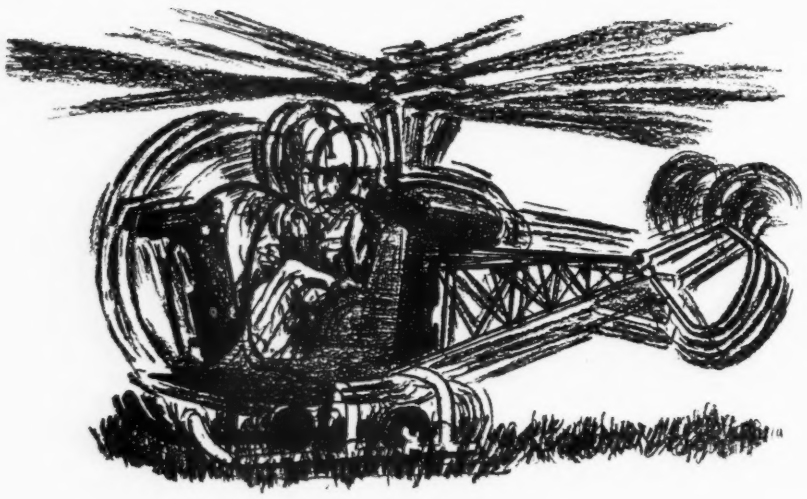
The Helicopter

by Flap Back

SO FAR AS the British army is concerned the helicopter is clearly the machine of the future. Indeed it is nowadays so much of a status symbol that no ambitious officer on the general list can risk being seen embarking in a fixed-wing aircraft. So you people really ought to get to know something about the helicopter. I know this is difficult, because of the inherent incapability of the helicopter pilot to tell you what the hell is happening. This article is an effort to give you some of the facts about helicopters which may elude you if you conduct your quest for information through the usual channels.

At an early stage in your instruction you will be told that



the helicopter is inherently unstable. They're telling you! The blades of a helicopter are, of course, its wings, and no self-respecting fixed-wing pilot can have any truck with a machine in which the starboard wing is going in the opposite direction to the port wing. The chap who started designing this sort of machine must have been a wild optimist if he did not realise the kind of complications he was letting himself in for.

Because of this playful tendency of the wings to go in opposite directions, early helicopters suffered from what (with marked understatement) is described as "dissymmetry of lift"; in other words, they rolled over on their backs. To avoid this, someone had the bright idea of allowing the blades unlimited scope to flap upwards as they rotated; it was hoped with some justification that the intelligent blades would realise when they were getting too much uplift and start flapping to reduce it.

This brings me to the phenomenon of "rotor decay." Helicopter jargon is full of sinister and misleading terms of this kind, and fixed wing pilots are quite wrong if they suppose "rotor decay" to be something going on in all those helicopters they see moping dejectedly in the hangars. "Rotor decay" is, in fact, the unfortunate result of allowing blades to flap up without having enough centrifugal force to keep them from flapping right up into a neat, but rapidly descending, cluster, and it is directly responsible for one of the red lines on the motor rpm indicator.

There is another red line a bare touch beyond it to show the rpm which must not be exceeded under pain of losing the blades altogether. The needle is kept between these lines by frenzied application of the throttle, which is of the motorcycle twist grip type, except that it works in the opposite and unnatural sense and is of a sensitivity which (though abnormal at any time) varies according to the settings of other controls in the cockpit. All this makes the rotor rpm indicator an object of some fascination to the pilot and leaves him little time for such relatively unimportant matters as looking where he is going, observing that the cylinderhead temperature has reached white-heat, and the like.

As well as being allowed to flap, the blades are allowed—if they wish—to "drag," that is to lag behind or speed ahead. This, of course, involves further instability and compensations—and a set of fresh terms such as "Coriolis effect" and "Hooke's joint." The lay student is advised to lose no sleep in efforts to master these. Devotees of Sir Isaac Newton will not be surprised to hear that the rotation of the blades induces a twisting-motion of the helicopter in the opposite sense, which has to be countered by a lethal little propeller in the tail, revolving invisibly for the unwary to walk into. The pilot is relatively free from this hazard, but, as this propeller (or "tail-rotor" as it is quaintly called) takes its power off that of the main rotor, it has the intriguing effect of causing the aircraft to rise or fall as the pilot uses more or less rudder pedal. In this interplay of forces I need hardly tell you that we end up with an odd lateral force, which has to be compensated for by an extra tilt to the rotor and a further spate of complications.

I hope I am making all this quite clear.

In this short article there is not room to explain all of the many phenomena you will encounter, such as "recirculation," the "vortex ring effect," "overpitching," "blade-sailing," and the like. Forms 765C are available in the flight office, I trust. I must, however, touch upon two more things—"ground resonance" and "phase lag."

"Ground resonance" is about the most vicious and unfair of the helicopter's attributes; there are you, sitting on the ground, quietly minding your own business, and suddenly the creature proceeds without warning to shake itself to bits and quite likely to turn upside down in

the process; this is not right.

"Phase lag," the cause of which I will not explain here, would normally result in having to move the stick to the left to move forward, forward to move to the right, and so on; it is remarkable for one reason only and that is that for once the designers have adjusted things so that the pilot at least can move the stick in the natural direction. The stick (called "cyclic stick" to confuse you) is thus the only logical control in the cockpit.

Before describing the cockpit I must emphasize that, as with fixed-wing flying, the study of "Principles of Flight" must march step by step with practical flying instruction. You will be fascinated by helicopter "P. of F." and by your instructor's skill in finding ways and means of proving entirely contradictory theories. Note the value of Newton's third law of motion, and where your instructor ends up with a force pointing in the wrong direction, note how swift he is to introduce "the equal and opposite reaction" to that force.

Returning to the cockpit we find the student, seated in the right-hand seat to show his independence of fixed-wing practice, with his right hand on the stick, his feet on the tail-rotor pedals, and his left hand sweatily grasping the throttle control at the top of the collective pitch lever.

We liked the stick, you will remember, and you may treat it as if it were the control column of a fixed-wing aircraft. Purists will say that is nonsense since it has effects at the hover quite different from that of a control column; never mind all this, because Austers can't hover, quite. There is a trimming device on some helicopters, but don't expect too much from it.

The pedals feel like rudders until you start using them—then they feel like hell, and as I have explained they move you up and down as well as sideways.

The collective pitch lever moves you up or down, too. It does this at your demand, but it also does so disconcertingly if you let go in order to scratch your nose.

Wags in the helicopter design department claim to have "correlated" the movement up and down of the lever, and the consequent change in rotor blade pitch, with the appropriate throttle settings. You will nevertheless find that convulsive movements of the throttle are necessary every time the lever is moved to prevent the blasted needle of the rotor rpm indicator from trespassing beyond its narrow preserve.

On the pilot's right is a small door pocket for maps, etc. The pilot quickly appreciates, however, first, that he has no hand available to hold a map, let alone refold it or turn it over, and secondly, that the occasional bird-like glances he can spare from the rotor rpm indicator are insufficient for accurate map-reading.

Beyond the collective lever is the most important instrument in the cockpit—your Q.F.I. In a fixed wing cockpit there is an atmosphere of calm somewhat lacking in the helicopter; helicopter Q.F.I.s do not lean back dreamily thumbing through "Air Clues" while you fly them round the circuit; their hands and feet are ever tensed for action, and the student cannot tell whether the tremors and jerks which so constantly afflict him emanate from his instructor or from feedback from the many instabilities of this remarkable machine. It will no doubt be with some surprise that he learns he is to go solo, and when he gets airborne his surprise will intensify.

Well, there we are and there is the helicopter, the machine of the future. I trust you pilots of the future will have derived some help from this article and will approach your helicopter conversion in the correct pioneering spirit.

Glossary of Terms

Dissymetry of lift. Condition where advancing blade gains more lift than retreating blade, causing a rolling effect around longitudinal axis of helicopter.

Rotor decay. Not "dying of old age," but loss of rotational velocity (rpm)—more often at an alarming rate if blade pitch angle is too great—"coning-up" is resultant.

Rudder Effect. Main and tail rotors are driven from one primary gearbox. If tail rotor power required is increased by increased rudder movement, main rotor power is decreased, ergo the helicopter will descend because rpm will have decreased also.

Recirculation. Within ground cushion effect, if helicopter is adjacent to air obstruction (wall, hangar, etc), there is a danger of downward airflow being forced outwards and upwards and re-entering the down-flow a second time. This can be hazardous.

Vortex ring. Power settling.

Blade sailing. When starting up the rotor and before an adequate rotational velocity is achieved, any blade moving forward into a strong wind will get more lift than a retreating blade, which will descend. There is a danger of the lowered blades severing the tail.

Form 765C. The aviator's nightmare—an accident report form.

Phase lag. Rotor disc is in effect a gyroscope. A force applied at any point does not become effective until a later position on the circumference. Is gyroscopic precession and is 90° lagging behind force applied.

Wags. Individuals possessed of uninhibited facetiousness and a "warped" sense of humour.

Q.F.I. Qualified flying instructor —sometimes referred to as "quite fearsome individual." American counterpart is IPs—issuer of pink slips.

The helicopter under discussion is a Skeeter (similar to OH-13 and OH-23).

TWX EXCERPTS

From April and May

prepared by
THE U. S. ARMY
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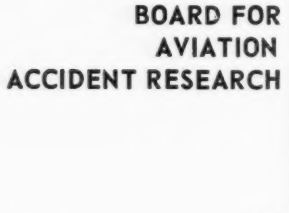
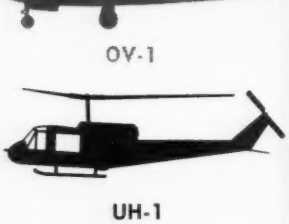


OV-1



UH-1

U-1A

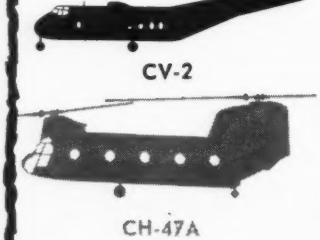
CH-21

O-1

U-6

CH-34

CV-2

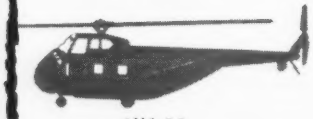


CH-47A

OH-13

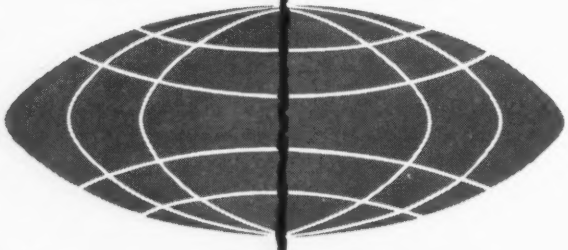
U-8

CH-37



UH-19

OH-23



OH-13G LOST POWER after takeoff over lake and landed in approximately 3½ feet of water. Aircraft destroyed. Pilot and passenger sustained minor cuts and scratches. Distorted venturi found in carburetor.

OH-13H STRUCK WIRES during low-level flight through valley. Minor damage to pitch change rods, plexiglas, and landing light bracket. Powerline poles obscured by trees.

CH-21C CYLINDER HEAD temperature rose rapidly in flight. Power was reduced and aircraft landed. Maintenance inspection revealed no cause for rise in temperature. Suspect temporary malfunction of temperature indicating system due to heavy rains and high humidity.

OH-23D TAIL ROTOR STRUCK ground during demonstration power recovery from practice autorotation. Aircraft came to rest on right side. Major damage to all components. No injuries.

OH-23D STRUCK WIRE approximately 50 feet above ground during approach to helipad. Incident damage to bubble, drive shaft, and tail rotor control cables.

CH-34C ENGINE BACKFIRED and lost power in flight. Suspect failure of No. 3 exhaust valve.

CH-47A YAWED TO RIGHT at termination of landing approach, and severe vibration (droop stop pounding) was experienced. Aircraft landed in uncontrollable turn to right. During shutdown, rotor blades struck fuselage. Major damage to fuselage, synchronized drive shaft lord mounts, drive shaft, and tail section. No injuries.

O-1A COLLIDED with buzzard during landing approach. Incident damage to landing light and wing.

UH-1B STRUCK WIRES, crashed and burned. Pilot, copilot, and one passenger sustained fatal injuries. One passenger sustained serious injuries, and crewchief sustained minor injuries.

UH-1B TOUCHED DOWN on heel of skids during practice autorotation. Application of aft cyclic caused main rotor to strike tail rotor drive shaft. Incident damage to tail rotor drive shaft, shaft cover, and main rotor blade tip.

OH-13H LOST POWER in flight. Autorotative descent was started and engine revived approximately 50 feet from ground. Power-on landing was made. Caused by failure of left magneto.

UH-19C ENGINE SPUTTERED at 200 feet during climb after takeoff, caught, sputtered again, and lost power. Minor damage to tail rotor, tail rotor gear box, ADF antenna, and tail cone occurred during landing. Suspect impeller failure.

UH-19C EMITTED SMOKE from engine compartment in flight. Caused by crack in No. 7 cylinder.

CH-21B CHIP DETECTOR warning light came on in flight. After landing, small sliver of metal was found across chip detector plug terminal.

OH-23D SETTLED during flare for practice low-level autorotation touchdown. Major damage to tail rotor blades, gear box, and tail boom. No injuries.

OH-23D LANDED TAIL LOW during practice autorotation touchdown. Incident damage to pogo stick, tail rotor blades, one inch drive, and tail boom. Caused by insufficient pitch application.

CH-34C ENGINE BACKFIRED during approach with external load at approximately 50 feet. External load was released and landing completed. Engine rpm decreased to 2000 at touchdown. Caused by carburetor malfunction. Suspect ruptured diaphragm.

O-1A LOST RPM during flight. While attempting to adjust throttle, pilot noted throttle linkage disconnected at quadrant. He used push-pull rod to adjust power and completed landing. Caused by broken cotter pin in connection between throttle lever and push-pull rod.

U-6A LOST POWER in flight. Caused by crack in No. 3 cylinder head.

U-1A CRASHED AND BURNED shortly after takeoff. Pilot and crewchief sustained fatal injuries. Instructor pilot sustained 75 percent third degree burns. Suspect severe downdraft on climb-out course in vicinity of rugged terrain.

U-8D NO. 2 ENGINE RPM decreased and aircraft veered right during takeoff roll at 45 knots. No. 1 engine was throttled back and aircraft was stopped. No. 2 propeller found in full feather position. Suspect failure of idler gear governor drive (FSN 2810-523-3151), shaft idler gear (P/N 68036), and spur gear (FSN 2810-200-1135).

CV-2B STRUCK TREE during landing roll. Aircraft caught fire and burned. No injuries. Weather not a factor.

CV-2 RIGHT ENGINE BACKFIRED during flight. Caused by buckling of No. 13 cylinder push rod.

OH-13G ROLLED on right side during landing. Major damage to all components. High gusty surface wind reported in area at time of accident. No injuries.

CH-21C CHIP DETECTOR warning light came on in flight. Ring fuzz shorted magnetic plug.

OH-23D TAIL ROTOR BLADES struck ground during practice 180° autorotation. Incident damage to tail rotor blades. Caused by holding flare too long.

CH-34C ENGINE RAN ROUGH and lost rpm shortly after takeoff. Excessive metal particles found in magnetic sump plugs. Suspect failure of main bearings.

O-1E CRASHED while circling small town during night cross-country. Suspect pilot experienced vertigo, lost control, and crashed. Weather (haze) obscured horizon and contributed to loss of orientation. Pilot sustained fractured facial bones and severe lacerations of head and face.

O-1A STRUCK TREES during go-around from strip landing approach. Major damage to wing, flap, horizontal stabilizer, and elevator. No injuries.

OH-13G ROCKED BACK after landing on 4,000-foot pinnacle and was picked up to hover. Uncontrollable right turn started and tail rotor struck rock. Directional control was lost and pilot bottomed pitch to avoid movement toward cliff. Tail rotor and main rotor demolished. Extensive damage to airframe. Suspect gusty winds.

CH-21C ENGINE LOST POWER in flight and failed at touchdown. Engine oil pressure had been lost during prior flight. Maintenance was performed and oil pressure returned to normal.

OH-23D EMITTED NOISE resembling excessive rpm, followed by heavy metallic knocking in flight. Aircraft was autorotated and came to rest upright. Major damage to tail boom, tail rotor blades, cross tubes, and other assemblies. No injuries.

CH-34A ENGINE MADE loud noise and lost power in flight. Needles split. Landing made with available power. Front spark plug of No. 3 cylinder improperly installed. Plug worked loose and blew through cowling.

CH-47A FIRE WARNING LIGHT came on in flight. Caused by oil leak. Hot oil activated thermocouple.

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

The Bird Dog

"We'll never get the accident rate down with all those Bird Dog groundloops!"

"It's that spring gear! It'll bounce you sideways before you know what's happened!"

"We need more elevator travel to keep the tail down!"

"I say we need a tricycle gear!"

These and many other insults have been heaped on the Bird Dog since it first appeared. A fledgling aviator, overhearing the average groundloop bull session, would be convinced that he's in for a terrible ordeal. How could anyone hold such an aircraft straight?

Are the many tail-chasing stories we hear justified? Does the Bird Dog have a built-in groundloop?

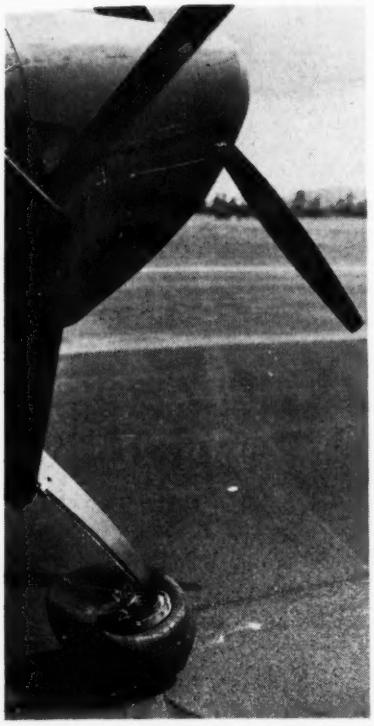
Before you answer, consider the statistics which show a steady decrease in major groundloop accidents during the past three years. There were 48 such accidents during 1960 and 38 during 1961. For the 12 months of 1962, 0-1 aircraft flew a total of 404,723 hours and had only 34 major groundloop accidents for a major groundloop accident rate of 8.4! When you consider that this includes all flying training in the aircraft and, at a modest estimate, more than a million landings, this record is truly amazing. Consider also that these 34 accidents produced only one minor injury.

In an effort to further improve this impressive record, Crash Sense presents the 1962 major groundloop accidents and their causes.

Aircraft landed on right side of road. Right wing struck brush and trees, causing swerve.

Relaxed crosswind correction during roll

Overcorrection for landing roll swerve



Overcorrection for landing roll turn

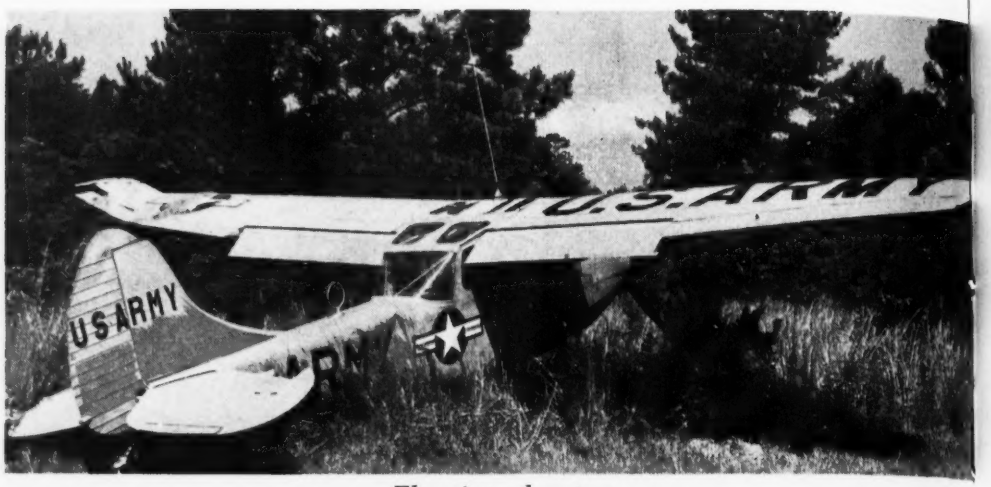
Flapping elevators

Late correction for slow turn in light crosswind

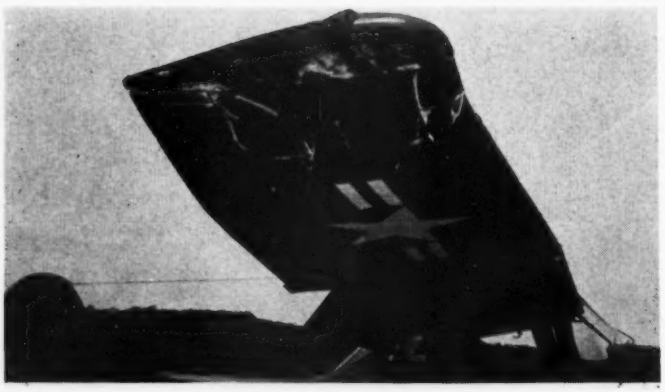
Relaxed crosswind correction

Overcorrection for landing roll swerve

The Bird Dog



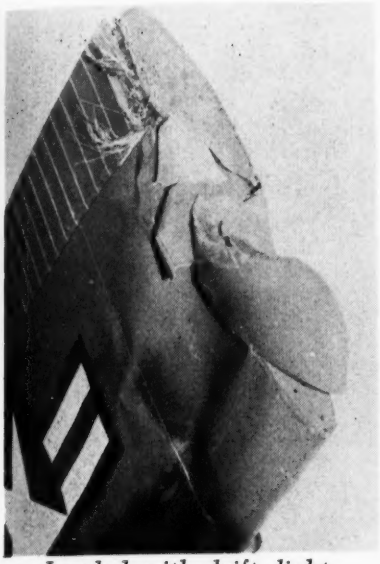
Flapping elevators



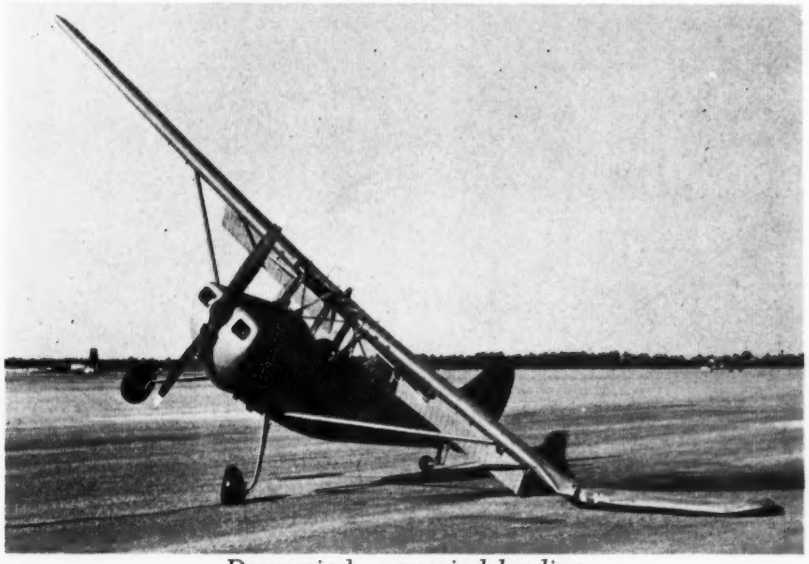
Inadequate crosswind correction

Landed with drift in light crosswind

Overcorrection for landing roll swerve

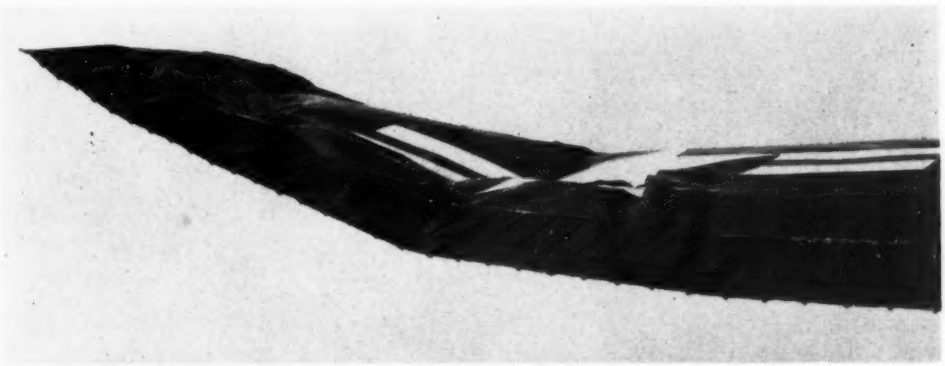


Landed with drift, light crosswind



Downwind, crosswind landing

Started taxiing before end of landing roll

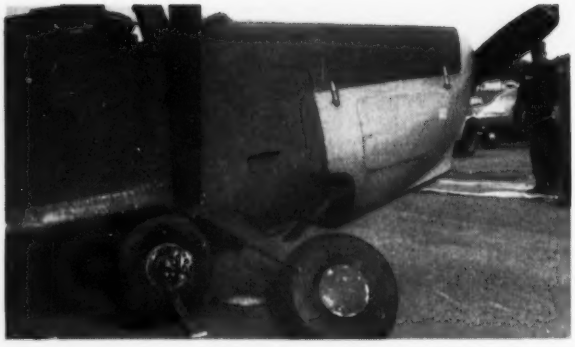


Postflight cockpit check during landing roll

Flapping elevators

The Bird Dog

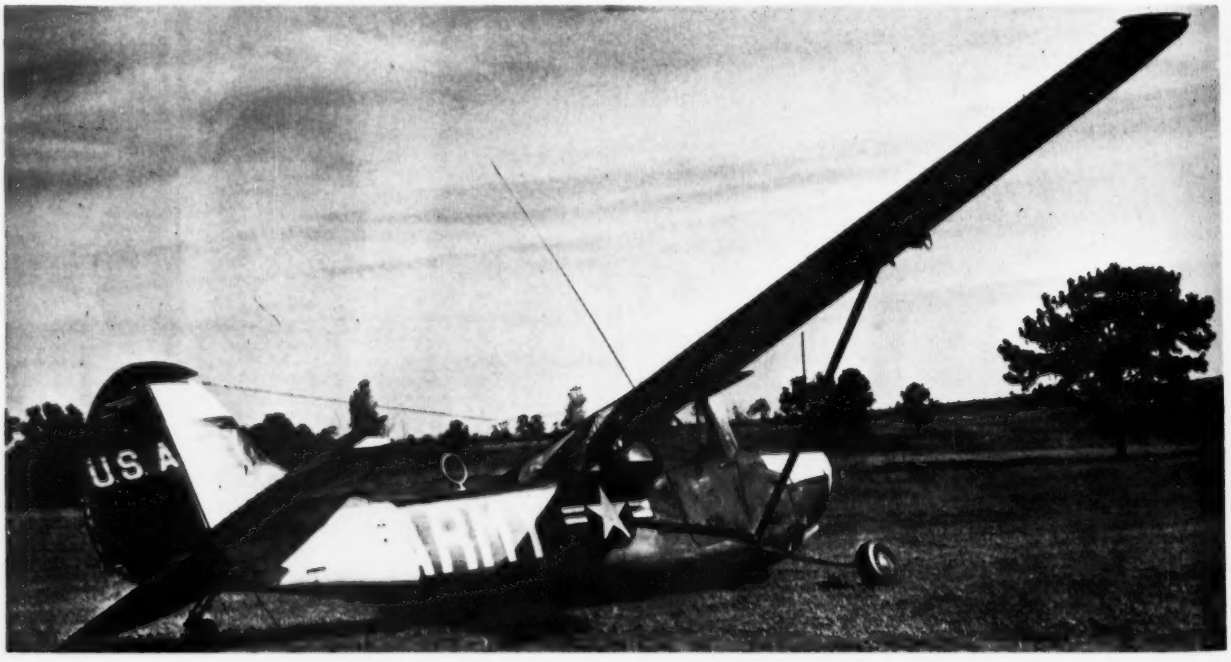
Too little, too late



Inadequate crosswind correction, possibly aggravated by CH-34 rotor downwash

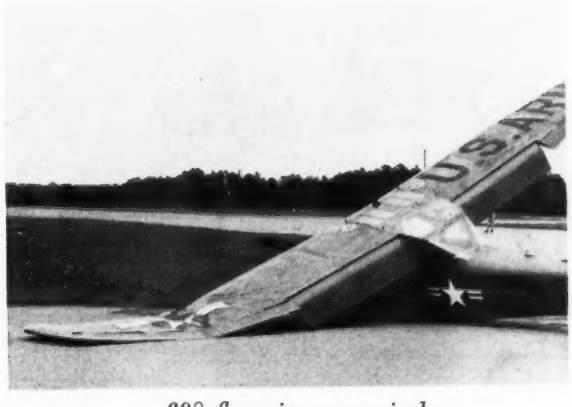
Inadequate crosswind correction

Rolled into depression, bounced, failed to correct for crosswind, and landed with crab



Landed with crab

High roundout, drop-in bounce landing, crab



60° flaps in crosswind

Landed with drift in light crosswind. Aggravated by power after loss of directional control.

The Bird Dog

The typical description of most Bird Dog groundloop accidents runs something like this: "The aircraft made a *normal* approach, a *normal* 3-point touchdown, rolled straight for 100 feet, then began a turn to . . ."

And the pilot's statement for this type of accident usually goes, "When the aircraft started to turn, I applied rudder. When the turn speeded up, I applied brake, but . . ."

Almost never, in this type of accident, do you find the statement, "I applied rudder, brake, and upwind aileron before I'd turned 5°." The reason for this is obvious. Pilots who can make this statement seldom have groundloops.

The cure is to be found with—

The approach. More often than not, a bad approach means a bad landing. Take it around and you eliminate this cause.

Positive elevator control. Flapping elevators mean bouncing tailwheels, and bouncing tailwheels are extremely hard to steer. The only place for the stick during a landing roll is full back.

Positive crosswind control. Perfect alignment during roundout and touchdown is wasted when upwind aileron is released during the roll. The need for aileron increases in direct proportion to the decrease in landing roll speed.

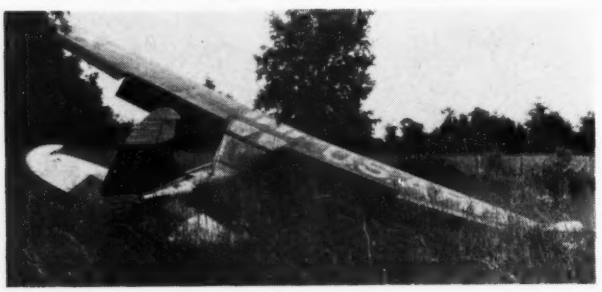
Flap judgment. Using 60° flaps in any kind of crosswind is begging for trouble.

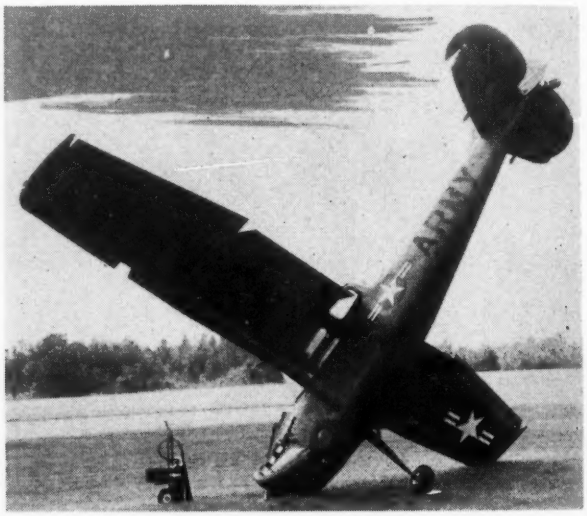
Alertness. Light crosswinds trap more pilots than do stronger and more obvious crosswinds. The slow turn develops into a violent swerve and the pilot's statement reads, "I applied rudder, then brake, but . . ."

Loose tailwheel mounting bracket bolt

Landed with crab in calm wind

Overcorrection for initial landing swerve





Too little, too late

60° flaps in crosswind

A Year on the ROAD

Continued from Page 6

1st ARMORED DIVISION CLASS III & IIIA

Supply & Trans BN Capacity		Division Daily Req Vehicles* & Aircraft**	
5,000 Gal Tankers	100,000 Gal	MOGAS	103,600 Gal
1,200 Gal Tankers	7,200 Gal	AVGAS	2,468 Gal
500 Gal Drums	18,000 Gal	JP-4	16,080 Gal
Total Capacity	125,200 Gal	Total	122,148 Gal

* 20 Mile Cross-Country
** 4 hr per RW, 6 hr per FW

Figure 7

cision by the Department of the Army to drop all grades of aviation fuel except 115/145 and JP-4 solved the problem before brigade and division field exercises started. After that the maximum was three grades of fuel, counting the addition of TCP to 115/145.

After all of the division's aviation units were formed (and prior to August), full TOE of many items, including gas tankers, was reached. During the division field evaluation exercise IRON FIST in August, resupply of aviation fuels was accomplished from the fixed facilities at the Fort Hood airfield. This involved a turn-around time of 5 to 6 hours and a total distance traveled of over 50 miles to resupply each tanker. As figure 7 reveals, the division mogas requirement almost equaled the quantity carried in the organic tankers of the supply and transportation battalion. The avgas requirement is based upon full TOE of authorized types of aircraft. The large mogas requirement and the absence of 500-gallon collapsible drums within the division eliminated the possibility of supply and transportation personnel being able to provide backup fuel support.

The problems encountered in fuel management and the 50-mile trip for resupply, point out the urgent need of having organic 500-gallon collapsible drums to remain operational at all times. This was particularly noticeable in the aviation battalion, which had the additional requirement to have 115/145 and JP-4 available at the division headquarters.

S4 ORGANIZATION

The S4 section is very similar in function to that of a tank bat-

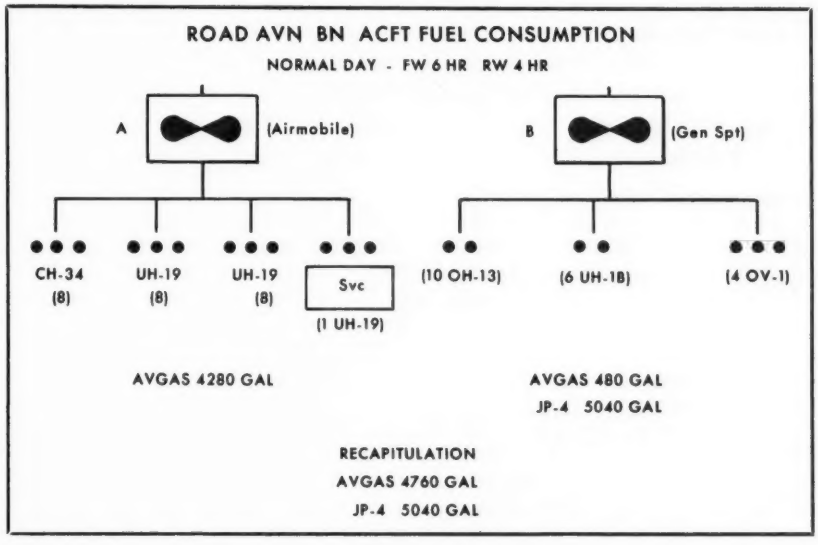


Figure 8

Figure 9

COMPARISON OF S4 ORGANIZATION
(SUPPLY & TRANSPORTATION FUNCTIONS)

(1-76E) S4 SECTION		(7-36E) S4 & SUPPORT PLAT	
1 CAPT S4	1 TRK ¾ TON	1 CAPT S4	2 TRK ¼ TON
1 E-7 SUPPLY SGT		1 LT SPT PLAT LDR	17 TRK 5 TON
1 E-3 CLERK/DRIVER		1 LT TRANS SEC LDR	6 TRK POL 1200 GAL
3		1 CWO UNIT SUP TECH	2 TRL ¼ TON
		1 E-7 SUPPLY SGT	2 TRL 1½ TON
		1 E-6 ASST SUPPLY SGT	
		1 E-6 TRK MASTER	
		1 E-5 AMMO SGT	
		5 E-5 SR HV TRK DVR	
		2 E-4 GEN SPT SP	
		11 E-4 TRUCK DRIVER	
		8 E-3 TRUCK DRIVER	
		6 E-3 ASST TRK DVR	
		2 E-3 SUPPLY CLERK	
		6 E-3 AMMO HANDLER	
		48	

talion. Figure 9 shows a considerable difference in personnel. Both sections are characterized by the following responsibilities:

- support of companies dispersed over wide distances (the aviation battalion wider and in the 3d dimension),
- property accountability for numerous diversified items,
- staff planning for logistical support during rapidly moving operations.

The one big difference in the sections is the ammunition requirement in the tank battalion. Of course, certain aircraft in the aviation battalion are to be armed and the problem of resupply has yet to be explored.

Since the activation of the aviation battalion, the S4 section has been augmented with additional personnel to meet the day-to-day requirements of expanding from a company to a battalion.

The man-equipment ratio in the aviation battalion is astounding. It is .8 man for each major item of equipment, and if each officer is given a toolbox, the ratio goes up to 1.5. (The mechanized battalion is about 3.8 to 4.5.) This ratio of less than one enlisted man per major piece of equipment is reached by counting only those items that require constant day-to-day maintenance, such as aircraft, vehicles, trailers, drones, and engineer type equipment. Close attention to maintenance management is a must for overall equipment availability and mission accomplishment.

AIRCRAFT AVAILABILITY

Reactivation of the division severely strained aircraft resources in both the Fourth Army area and CONUS. To bring the 1st Armored from the 15 aircraft level of old combat command A to the neighborhood of 103 aircraft authorized in a ROAD division, numerous substitutes for TOE aircraft were made. These have all fallen short of TOE models, either in performance or flight availability.

The OH-13 Sioux, substituted for the still developmental LOH, came mostly from Reserve and National Guard units and were outdated E and G models running from "jewels" to complete "dogs." One still had irreversibles and most lacked FM. The result was volumes of correspondence and many TWXs to speed up the retrofit program. The performance of these aircraft was critical during the hot Texas summer and their availability left something to be desired.

The division received fifteen UH-19Ds, ten CH-34s, and nineteen UH-1Bs to meet its utility helicopter requirement. The UH-19D, a real workhorse, had a generally acceptable availability record, but its cargo capacity is so limited that its value for all airmobile and cargo lift missions is negligible. It ended up being used as a taxi and G2 vehicle.

The CH-34 is a perfect substitute for any utility helicopter; however the Choctaw's availability was generally poor due to the age of the aircraft assigned and a parts supply problem. Initially the problem was somewhat compounded when the aircraft were split between the air cavalry troop and the aviation battalion.

The performance of the UH-1B was outstanding and the availability was high, limited only by the long "pipeline" time for replacement of major components. The issue priority of these aircraft was to the air cavalry troop because of the critical performance area in which they habitually operate.

THIRD ECHELON MAINTENANCE

Third echelon maintenance of aircraft in the division is done

by the Aircraft Maintenance Company, part of the maintenance battalion assigned to the division support command. Close coordination is required between the division aviation officer, the G3, and the commander of the maintenance battalion to ensure that routine training and administrative requirements do not interfere with operational needs. One solution might be the inclusion of the Aircraft Maintenance Company in the aviation battalion, thereby enabling the aviation officer to establish maintenance priorities in conjunction with G3 operational requirements.

MOTOR MAINTENANCE

The conversion late in the summer of 1962 to the TAPER records system brought about much training and additional work. It was mainly a change of forms for aircraft maintenance personnel. However, it was a completely new concept and workload for the motor maintenance people. The battalion maintenance section has very similar functions to those of the maintenance platoon in the mechanized rifle battalion (fig. 10). Those individuals marked with an asterisk in figure 10 also have duties with the aircraft maintenance functions of the battalion maintenance section.

Both organizations handle the second echelon maintenance of the headquarters companies in their respective battalions. In addition they provide normal backup second echelon maintenance, repair parts supply, and evacuation support for the entire battalion. The main difference between the two is the absence of track vehicles in the aviation battalion.

The aviation battalion has far more engineer equipment—over 80 pieces—than any other battalion in the ROAD division, except the Engineer battalion. Also, the aviation battalion has one man who is the counterpart of the E-4 powerman in the mech battalion. He is located in the battalion communications section and is required to operate and maintain the power equipment necessary for running the division instrumented airfield.

In every case the battalion line companies have had to augment their motor pools with aircraft maintenance personnel to achieve and maintain an acceptable degree of maintenance. All proposed revisions of TOE have provided for more engineer and motor maintenance personnel.

MAINTENANCE OF SURVEILLANCE EQUIPMENT

One area of maintenance in the division that is virtually unexplored is that of the sophisticated aerial surveillance equipment, since the division has had only a few of these items, mainly on a loan basis. During THREE PAIRS, the division was loaned a Mohawk with infrared. Qualified infrared maintenance personnel are not available in the division, and when this piece of equipment broke down, the only way to get it repaired was to bring in a factory repairman. The reliability of this type equipment is as yet unknown, but there is the distinct possibility that the only way of effectively maintaining it in the division will be by means of maintenance floats. An additional problem in operations and maintenance would develop if the full TOE inventory of these items was received just before an emergency movement overseas.

MOBILITY

In the area of mobility, a problem area exists where aircraft maintenance tools are concerned. The division has four C sets of aircraft maintenance tools. Each

weighs 14,155 lbs, has over 620 items and occupies 1,541.2 cubic feet. One is in each of the line companies of the aviation battalion and two in the cavalry squadron (where one of the sets is used by eight people). In addition, each brigade aviation platoon has a B set, somewhat smaller than the C set. During the STRAC move the C set, along with the repair parts for 15 aircraft of 5 types, would not fit into two 2½-ton trucks with trailers, one ¾-ton truck with trailer, and one 2½-ton shop van with trailer.

The use of organic aircraft in a ROAD division to transport unit equipment is a definite limitation on aviation capability. This has been recognized in Europe where helicopter companies are 100 percent mobile without the use of aircraft. Additional ground vehicles have been given to these companies, freeing the aircraft for the more important operational missions. Division moves will cause unit displacements far more frequently than for units assigned to Corps or Army. Aviation support in a division cannot be limited by routine matters such as unit displacement. The obvious result of a conflict between mission requirements and air transport of tools is the discarding of valuable tools. Unless additional aircraft are assigned, sufficient ground vehicles should be authorized for complete mobility.

ACCIDENT PREVENTION

The 1st Armored Division has had a fulltime aviation accident prevention officer since it was reactivated. This is not a TOE position, but due to the amount of aircraft in the ROAD division, it was deemed necessary to have a qualified officer to supervise and monitor the division accident prevention program.

COMPARISON OF MOTOR MAINTENANCE

BN MAINT SEC		ITEM SPT
* 1 CAPT	MAINT OFF	94 TRUCKS
1 CWO	MOTOR SUPV	89 TRAILERS
1 E-6	MOTOR SGT	183
1 E-5	SR WHEEL VEH MECH	
3 E-4	WHEEL VEH MECH	
2 E-3	MECH HELPER	
* 1 E-3	CLERK TYPIST	
10		

BN MAINT PLAT		ITEM SPT
1 CAPT	MOTOR OFF	71 APC
1 CWO	AUTO MAINT TECH	5 RECOV
1 E-8	MAINT SGT	2 TANK
1 E-7	ASST MAINT SGT	87 TRUCKS
2 E-5	SR RECOV MECH	75 TRAILERS
4 E-5	SR TRACK VEH MECH	240
1 E-5	SR WELDER	
1 E-4	ORD SUP SP	
1 E-4	POWERMAN	
2 E-4	RECOV MECH	
12 E-4	TRACK VEH MECH	
1 E-4	WELDER	
6 E-3	MECH HELPER	
1 E-3	RECORDS CLERK	
1 E-3	SUPPLY CLERK	
36		

Figure 10

ACCIDENTS AVERTED		
CH-34	Hung Load	$ 200,000
CH-34	Engine Failure	200,000
UH-19	Engine Failure	137,475
UH-1B	Flame Out	239,162
UH-1B	Engine Failure	239,162
OH-13	Contaminated Fuel	34,630
UH-19	Broken Stud Bolt	137,475
UH-19	Cracked Cylinder	137,475
OV-1	Prop Feather On T/O	1,559,881.33
	Total	$2,885,260.33

Figure 11

The AAPO wears a yellow brassard to indicate his position and emphasize his importance to the program. He is a member or advisor on all aircraft accident investigations. He has been, and should be when possible, a graduate of the aviation safety course, University of Southern California.

The division aviation accident program emphasis is on human factors.

Unfortunately, even with the best of prevention programs, there will always be accidents. Accordingly, a preaccident plan was developed, specifically designed to work in the Fort Hood area, but with sufficient flexibility to be used anywhere the division might be deployed. It is tabbed into separate sections for each agency which might be concerned in the event of an aircraft accident. Should the division move to a different location, minor changes are all that is necessary to update the plan.

Also, accident investigation kits were prepared for use by

Figure 12

ACCIDENTS NOT AVERTED

MAJORS	INJURY	COST	FLYING HRS
501st 2	2 Minor	$210,000	8,761
1st Bde 3	3 Fatal	243,000	782
2d Bde 1	None	3,000	464
D Trp 1	None	12,000	2,857
		$468,000	12,864

board members and are immediately available at any time. Four accident investigating teams were organized to ensure that, regardless of leaves, TDY, etc., a sufficient number of qualified *board* members will be at the scene of an accident as expeditiously as possible. Experience has proved that the preaccident plan is sound and workable.

The word "safety" is seldom, if ever, used in regard to the 1st Armored's program. Rather, a new approach has been tried. Over the years the word "safety" has developed a stigma. Men—be they infantrymen, tankers or aviators—immediately acquire a glazed look when they hear "safety program," "safety meeting," "safety lecture," and the like. It seems to induce a comatose state in everyone, *before* the speaker begins. Consequently, the term "prevention" is used wherever possible, in hopes it will be more stimulating.

Another device successfully used is the "those we didn't have," or "corncob pipe program." [The commander of the 501st Aviation Battalion is rarely seen without a corncob pipe fired up.] Whenever an aviator, through proper technique and good sense, safely and without incident averts what looms as a certain accident, his feat is recognized by formal presentation of a letter of commendation and a corncob pipe. A small plaque is affixed to the pipe with the words "I saved one," the name of the pilot, the date of the incident, and the type of aircraft. Thus far there have been nine presentations (fig. 11).

Recognizing a job well done emphasizes everyone's prevention job. A fringe benefit is that people remember these "saves" as well as the small number of actual accidents. This results in an emotional balance regarding aircraft accidents.

No discussion of accident prevention is complete without statistics showing the accidents not prevented (fig. 12).

The growing density of aircraft in our tactical units demands that an increased emphasis be placed on the accident prevention role. The mounting cost of equipment and personnel makes an accident-free program even more important.

HELICOPTER ARMAMENT

During its first year on the ROAD, the 1st Armored Division employed the helicopter armament systems discussed below.

XM1-E1 machinegun kit (fig. 13): This kit is mounted on the OH-13 and includes twin .30 cal flexible machinegun mounts with recoil absorption devices. The guns are pneumatically charged, electrically operated, and can be elevated 11 degrees.

The combined cyclic rate of fire is 1,300 rounds per minute, and each gun has an ammunition supply of 650 rounds.

Old Ironsides machinegun kit (fig. 14): Mounted on the OH-13, this kit also includes twin .30 cal flexible machinegun mounts with recoil absorption devices.

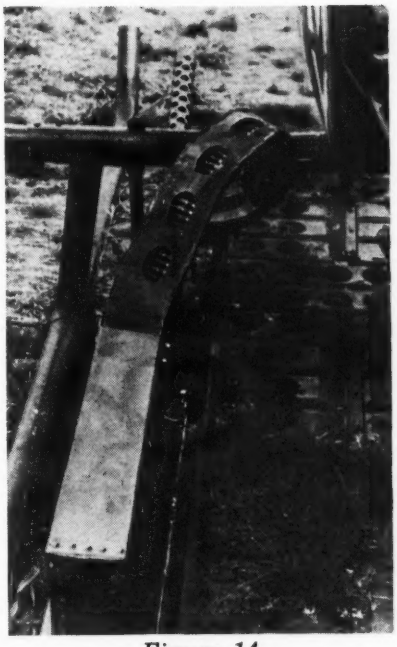


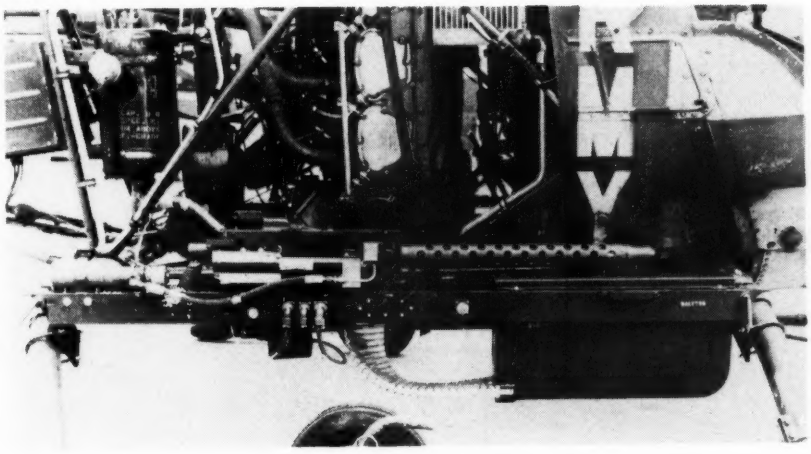
Figure 14

The guns are pneumatically charged, electrically operated, and can be elevated 15 degrees.

The combined cyclic rate of fire is 2,600 rounds per minute, and each gun has an ammunition supply of 1,000 rounds.

Iroquois .30 caliber machinegun kit (fig. 15): These kits were installed on the division's troop carrying UH-1Bs. Each includes twin .30 caliber flexible machinegun mounts with recoil absorption devices. The guns are pneumatically charged, electri-

Figure 13



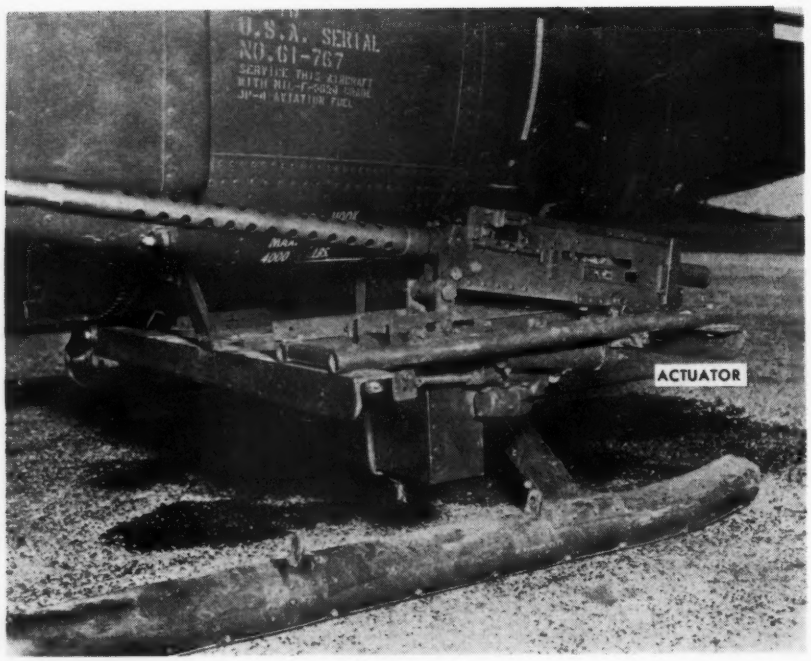
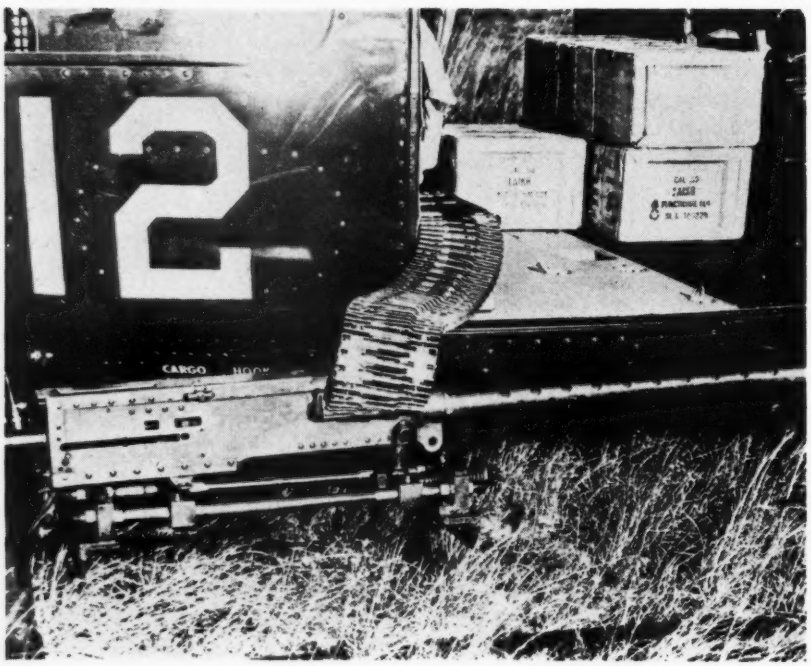


Figure 15

cally operated, and can be elevated 15 degrees. The system includes two safety switches—an electric circuit break to the trigger, and one which pneumatically holds the bolt to the rear.

The combined cyclic rate of fire is 2,600 rounds per minute, and each gun has an ammunition supply of 700 rounds. This system does not permit inflight reloading.

Figure 16



Iroquois .50 caliber M-2 machinegun kit (fig. 16): These kits were designed and built within the 1st Armored Division and are mounted on the UH-1B. Each kit includes twin .50 caliber machinegun mounts with recoil absorption devices. The guns are pneumatically charged and electrically operated. Safety switches are the same as used in the Iroquois .30 caliber kit.*

The combined cyclic rate of fire is 1,700 rounds per minute, and each gun has an ammunition supply of 400 rounds from cabin mounted boxes. The kit is reloadable in flight.

Iroquois .50 caliber M-3 machinegun kit (fig. 17): Mounted on the UH-1B, these kits incorporate twin .50 caliber machinegun mounts with Air Force Edgewater adapters for recoil adsorption. The guns are pneumatically charged and electrically operated. Safety switches are the same as in the Iroquois .30 caliber kit.

The combined cyclic rate of fire is 2,600 rounds per minute, and each gun has an ammunition supply of 400 rounds per gun from cabin mounted boxes. The kit is reloadable in flight.

Womack kit (fig. 18): This kit was manufactured within the 1st Armored Division and incorporates machineguns and rockets on the UH-1B.

Twin .30 caliber machinegun mounts are used with recoil ab-

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*This is the 1st Armored Division's system of gun switches.

Master Switch. Switch to activate the electrical system.

Load or Hold Switch. Used to load or clear gun and as safety to hold bolt to rear.

Safety Switch. Blocks or opens firing circuit.

Firing Switch

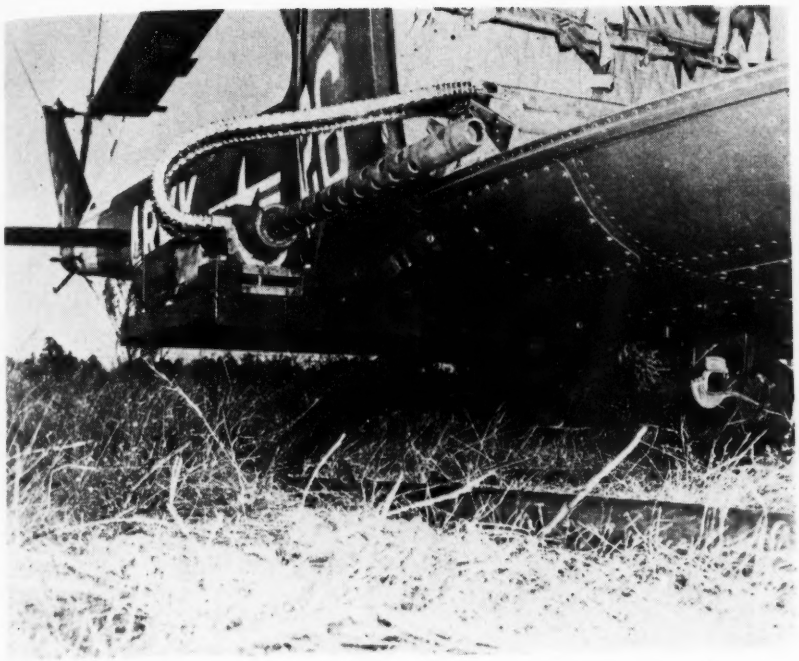
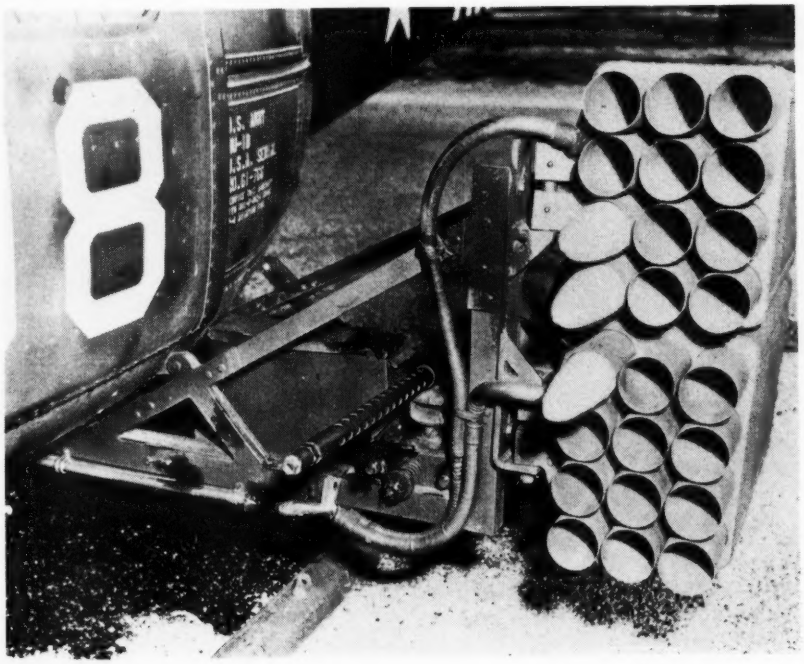


Figure 17

sorption devices. The guns are pneumatically charged, electrically operated, and can be elevated 15 degrees. The cyclic rate of fire is 2,600 rounds per minute. Each gun has an ammunition supply of 700 rounds and the kit is not reloadable in flight.

The kit also includes two 2.75" folding fin aerial rocket mounts each, with a capacity of 24 rockets. Firing is accomplished by an A-3 Intervelometer (rocket distribution panel). In single fire it fires single pairs (one per side) and in automatic fire it fires a 24 pair ripple in 208 milliseconds (about 4.5 seconds).

Figure 18



THE OUTLOOK

Below are recommendations and observations made by members of the 1st Armored Division after one year on the road:

• *Logistics and maintenance.* The logistic ability of the aviation battalion and the motor maintenance support needs reevaluation. Functional lines of maintenance and logistics are being realigned to come up with an improved maintenance system.

• *Aircraft Accident Prevention.* A fulltime aviation accident prevention officer in the division is justified. He helps establish a productive, realistic and workable plan, to include enlisted personnel. One is needed for each 17 or more aircraft.

• *Helicopter available power and speed.* For nap-of-the-earth flying the power to weight ratio should be 1 to 6. In utility helicopters it should be 1 to 10.

• *Technical inspectors.* One per ten aircraft or fraction thereof.

• *Technical supply specialists.* There is a school for these specialists, but it covers a vast array of equipment and does not concern itself specifically with the associated problems of aircraft components. The requirement should be one specialist for each ten aircraft or major fraction thereof to include third echelon level.

• *Man-equipment ratio.* A price in manpower must be paid to reduce the man-equipment ratio bogging down the ROAD division aviation units. The armor-infantry-artillery relationship

in equipment density must be approached or failure to meet a realistic combat stay time will result.

• *Armament.* Pilot controlled systems are favored over gunner-observer controlled systems because (1) the pilot must control the aircraft and its associated equipment and (2) the gunner cannot fire and navigate. It is advocated that as many controls as possible be placed on the cyclic stick. Simplicity and standardization of charging systems and armament mounts must be the keynote. Let's not go down the road toward bigger and bigger helicopters as the Germans did with their tanks.

• *Aircraft.* Reduce the types of aircraft in the Army inventory and simplify training and transition requirements.

• *Survival.* Survival training is a necessity for all aviation units and there should be a refresher course annually much like our instrument renewal program. Development of standard individual and aircraft survival kits for issue is needed.

• *Training.* All aviators must be familiar with nap-of-the-earth flying, its techniques, and low-level navigational procedures. All enlisted personnel must be qualified in their MOSs and a program of constant evaluation must receive command attention and interest.

• *Aerial gunnery ranges.* Extensive range firing is vital for an air cavalry troop. Range facilities for this type training are inadequate at the majority of Army installations.

• *Observers.* The four officer observers for the OV-1 Mohawk must be assigned to the aviation battalion before entry into a combat situation. This critical need is equally important for the scout platoon, air cavalry troop, and the division artillery aviation section.

• *Air traffic control.* The inadequate performance of the tracking and plotting radar (MPQ-29) used for vectoring aircraft and control of drone flights makes its retention in the TOE doubtful. The maintenance effort expended on this equipment could be better used on aircraft and vehicular maintenance.

Aviation in the ROAD division represents a great stride forward in the proper utilization of Army aircraft. One year on the ROAD with the 501st Aviation Battalion reaffirms that while there is much to learn, there is much to gain in the great, unexplored potential of Army Aviation. We have yet to realize the full potential of greatly increased surveillance capabilities. Every experience thus far indicates a tremendous new tool has been added to the Army division. Airmobile operations involving troop lift tend to overshadow the great potential for movement of tactical logistical loads. Both areas must be fully exploited, as either one can be a decisive tool for the division commander. The air cavalry troop concept provides the third new tool to the ROAD division commander and has proved to be a decisive tool of its own.

Attention: Reserve Component Units—

The U. S. Army Aviation School has been asked informally by several Reserve Component units to provide aircraft maintenance instructor assistance at summer training camps. Present high priority training requirements at Fort Rucker preclude the USAAVNS from providing such assistance this year.

Suggest that your Reserve or National Guard aviation unit plan to conduct aviation mechanic training with locally available instructor personnel, using Programs of Instruction, Master Lesson Plans, and film slides which are available in packet form from the USAAVNS. Complete information on how to obtain these POIs, MLPs, and slides is contained in the USAAVNS Instructional Material Catalog. If your unit does not have this catalog, you may obtain a copy by letter request to the Department of P&NRI, Fort Rucker, Ala.

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR FORCE DEVELOPMENT
WASHINGTON 25, D.C.

MEMORANDUM TO ALL PERSONNEL IN THE ARMY AVIATION PROGRAM:

My assignment as Director of Army Aviation comes as a great honor. I will aspire to follow the example of my predecessors, each of whom has made singular and significant contributions to the Army Aviation Program.

This assignment comes during a period of dynamic innovations in the concept and employment of Army Aviation.

I enlist and welcome the support of aviators and Army Aviation devotees throughout the world, and trust we'll work as dedicated partners in furthering the success of the program.

I look forward to my assignment as the Director of Army Aviation as one of challenge and satisfaction.

John J. Tolson

JOHN J. TOLSON, III
Brigadier General, GS
Director of Army Aviation

UNITED STATES ARMY
THE CHIEF OF STAFF

TWENTY-FIRST ANNIVERSARY OF ARMY AVIATION

On behalf of all the men and women of the United States Army, I extend congratulations and best wishes on the occasion of the twenty-first anniversary of Army Aviation.

Since its inception, Army Aviation has grown from a few essentially observation aircraft to a complex organization embracing practically all arms and services.

Through the Army's early pioneering efforts to provide maximum utilization of aircraft in support of combat operations, we find today increased mobility on the battlefield which was beyond imagination a few short years ago. With today's rapid advances in technology, Army Aviation will achieve ever-increasing importance and will be required to assume even greater roles and responsibilities.

All members of the Army join me in expressing pride in the many past accomplishments of Army Aviation and confidence in its ability to meet the important challenges of the future.

Earle G. Wheeler

EARLE G. WHEELER
General, United States Army
Chief of Staff